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Aggregate Resources Inventory of the
Parry Sound To French River Area
Northern Ontario

Ontario Geological Survey
Aggregate Resources Inventory
Paper 146

By Staff of the Engineering and Terrain Geology Section,
Ontario Geological Survey, Ministry of Northern Development and Mines

1989

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Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in cooperation with the Coal Association of Canada.

Aggregate Resources Inventory of the Parry Sound to French River Area Northern Ontario

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by Staff[1] of the Engineering and Terrain Geology Section

[1] Project Supervisor: I. Szoke; fieldwork and report by G.R. Jones and C.J. Dawson; compilation and drafting by Staff of the Aggregate Assessment Office.

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Abstract

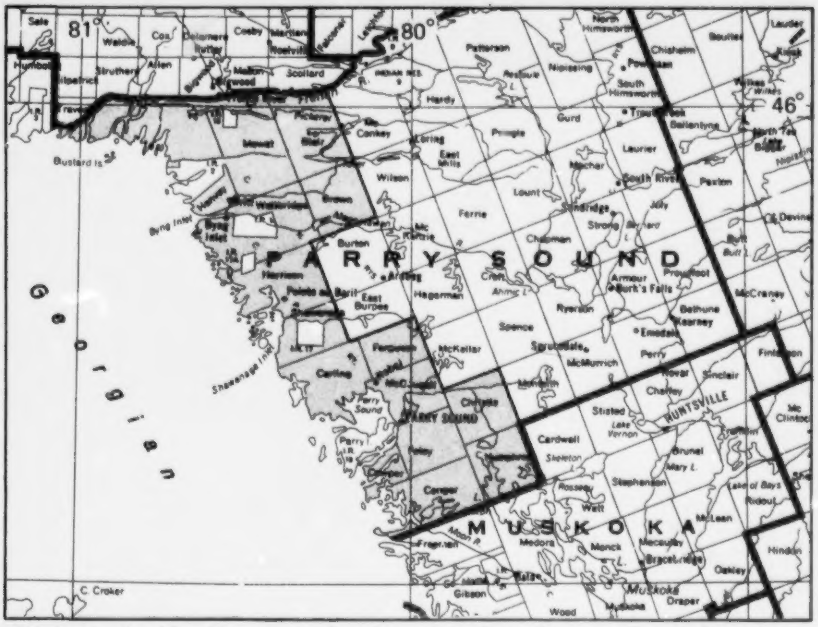

Figure 1. *Key Map Showing the Location of the Parry Sound to French River Area. Scale 1:1 584 000.*

This report includes an inventory and evaluation of sand and gravel resources as well as a discussion of bedrock aggregate potential in the Parry Sound to French River Area in northern Ontario. The report is based on previous studies in the area and a detailed field assessment undertaken in the summer of 1987. The investigation was conducted to delineate and determine the quality and quantity of aggregate within the area to help ensure sufficient aggregate resources are available for future use.

In the project area, 28 areas containing significant amounts of sand and gravel have been selected for possible resource protection at the primary level of significance. Most of these areas consist of subaqueous fan or ice-contact deposits. Selected Sand and Gravel Resource Areas occupy approximately 3750 acres (1520 ha). An estimated 2550 acres (1030 ha) are currently available for extraction, containing resources of approximately 79 million tons (72 million tonnes). In addition, numerous deposits have been classified as resources of secondary significance which add considerably to the resource base of the report area.

Selected Resource Areas are not meant to be permanent, single land use units. They represent areas in which a major resource is known to exist and may be reserved wholly or partially for extractive development and/or resource protection.

In general, the northern part of the report area and areas lying near the shores of Georgian Bay contain only limited amounts of aggregate. Deposits in these areas are usually small, isolated bodies suitable for local use, and large tracts of land contain little or no aggregate resources. Consequently, aggregate may have to be transported lengthy distances to supply construction needs in certain areas. The southern part of the project area contains relatively more aggregate resources.

The selected deposits typically consist of sandy aggregate suitable for uses including road sub-base, septic beds and fill. The main factor limiting aggregate quality is the presence of excessive quantities of fines within some of these depos-

its. Average thicknesses of the features usually range from 5 to 15 feet (1.5 to 5 m) thick. Bedrock and/or the water table is likely to be encountered within 15 feet (5 m) of the surface in many of the deposits.

Supplies of crushable gravel are lacking throughout the project area. Only one resource area is considered potentially capable of producing commercially significant quantities of crushed gravel. The gravel, where it is available in sufficient amounts, is suitable for most usual aggregate applications. However, locally produced aggregate is not accepted by the Ontario Ministry of Transportation for use in Portland cement concrete structures exposed to de-icing salts because there is a potential bonding problem between the aggregates and cement which results in concrete deterioration.

Because of the lack of high specification coarse aggregates, crushed aggregate is either imported or quarried locally to meet demands. The quarries primarily extract Precambrian gneisses of the Canadian Shield. This material is generally well suited for most aggregate uses except for some concrete applications.

Résumé

Ce rapport comprend un inventaire et une évaluation des ressources en sable et en gravier, ainsi qu'une étude du potentiel en agrégats de soubassement dans la région allant de Parry Sound à la rivière aux Français dans le Nord de l'Ontario. Il s'inspire d'études antérieures effectuées dans la région et d'une évaluation détaillée du terrain entreprise au cours de l'été de 1987, qui avait pour but de décrire et de déterminer la qualité et la quantité d'agrégats dans la région afin d'assurer un approvisionnement suffisant d'agrégats pour l'avenir.

Dans la région du projet, 28 zones contenant des quantités considérables de sable et de gravier ont été sélectionnées pour une protection éventuelle de ressources de première importance. La plupart de ces zones consistent en des cônes subaquatiques ou en gisements de contact glaciaire. Les zones sélectionnées de sable et de gravier occupent environ 3750 acres (1520 hectares). On dispose actuellement pour l'extraction d'une superficie de 2550 acres (1030 hectares), contenant des ressources d'environ 79 milllions de tonnes (72 millions de tonnes métriques). De plus, de nombreux gisements ont été classés comme ressources d'importance secondaire, ce qui augmente considérablement les ressources dans la région à l'étude.

Les régions sélectionnées comme réserves ne sont pas destinées à devenir des unités d'utilisation unique et permanente des terres. Ce sont des zones connues pour leur potentiel en ressources qui sont susceptibles d'être réservées en totalité ou en partie à l'extraction et (ou) d'être protégées.

En général, la partie nord de la région étudiée et les zones situées près des rives de la baie Georgienne ne contiennent que des quantités limitées d'aggrégats. Les gisements dans cette région sont habituellement petits et isolés convenant à l'utilisation locale, et de large bandes de terre renfermant peu ou pas d'agrégats. Par conséquent, les agrégats doivent être transportés sur de longues distances afin de suppléer aux besoins pour la construction dans certaines régions. La partie sud de la région étudiée renferme relativement plus d'agrégats.

Les gisements sélectionnés consistent généralement en des agrégats sableux propices à plusieurs utilisations, notamment de soubassement de routes, de bases et de poids de remplissage septiques. Le principal facteur qui limite la qualité des agrégats est la présence de quantités considérables de particules fines au sein de ces gisements. L'épaisseur moyenne des gisements est habituellement de 5 à 10 pieds (1,5 à 5 m). On peut rencontrer le soubassement et/ou la couche aquifére à 15 pieds (5 m) de la surface dans de nombreux gisements.

Il y a pénurie d'approvisionnements en gravier concassable dans toute la région étudiée. Seule une zone de ressources est considérée comme possédant un potentiel pour la production commerciale de quantités suffisantes de gravier concassé. Le gravier, lorsqu'il se trouve en quantité suffisante, convient à la plupart des utilisations d'agrégats. Cependant, les agrégats produits localement ne sont pas approuvés par le ministère des Transports de l'Ontario pour la construction de structures en ciment Portland exposées aux sels de déglaçage, parce qu'il se peut que l'adhérence entre les agrégats et le ciment ne soit pas adéquate, ce qui entraîne la dégradation du béton.

À cause du manque d'agrégats à gros grain de haute qualité, des agrégats concassés sont soit importés, soit extraits localement afin de répondre à la demande. On extrait surtout des carrières des gneisses précambriens du bouclier canadien. Ce matériau convient généralement à la plupart des utilisations d'agrégats, sauf certains bétons.

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Introduction

Mineral aggregates, which include bedrock-derived crushed stone as well as naturally formed sand and gravel, constitute the major raw material in Ontario's road-building and construction industries. Very large amounts of these materials are used each year throughout the Province. For example, in 1986, the total tonnage of mineral aggregates extracted was 136 million tons (123 million tonnes), greater than that of any other metallic or nonmetallic commodity mined in the Province (Ontario Ministry of Northern Development and Mines 1988).

Although mineral aggregate deposits are plentiful in Ontario, they are fixed-location, nonrenewable resources which can be exploited only in those areas where they occur. Mineral aggregates are characterized by their high bulk and low unit value so that the economic value of a deposit is a function of its proximity to a market area as well as its quality and size. The potential for extractive development is usually greatest in areas where land use competition is extreme. For these reasons the availability of adequate resources for future development is now being threatened in some areas.

Comprehensive planning and resource management strategies are required to make the best use of available resources, especially in those areas experiencing rapid development. Such strategies must be based on a sound knowledge of the total mineral aggregate resource base at both local and regional levels. The purpose of the Aggregate Resources Inventory is to provide the basic geological information required to include potential mineral aggregate resource areas in planning strategies. The reports should form the basis for discussion on those areas best suited for possible extraction. The aim is to assist decision-makers in protecting the public wellbeing by ensuring that adequate resources of mineral aggregate remain available for future use.

This report is a technical background document, based for the most part on geological information and interpretation. It has been designed as a component of the total planning process and should be used in conjunction with other planning considerations, to ensure the best use of the resources.

The report includes an assessment of sand and gravel resources as well as a discussion on the potential for bedrock-derived aggregate. The most recent information available has been used to prepare the report. As new information becomes available, revisions may be necessary.

Part I — Inventory Methods

FIELD AND OFFICE METHODS

The methods used to prepare the report primarily involve the interpretation of published geological data such as bedrock and surficial geology maps and reports (see References) as well as field examination of potential resource areas. Field methods include the examination of natural and man-made exposures of granular material. Most observations are made at quarries and sand and gravel pits located from records held by the Ontario Ministry of Transportation, the Ontario Geological Survey, and by Regional and District Offices of the Ontario Ministry of Natural Resources. Observations made at pit sites include estimates of the total face height and the proportion of gravel- and sand-sized fragments in the deposit. Observations are also made of the shape and lithology of the particles. These characteristics are important in estimating the quality and quantity of the aggregate. In areas of limited exposure, subsurface materials may be assessed by hand augering and test pitting, supplemented by test hole drilling or excavation, and geophysical surveys using hammer seismic equipment. The symbols for and locations of sample sites, test hole sites, and geophysical traverse lines are noted on Maps 1A, 1B and 1C.

Deposits with potential for further extractive development or those where existing data are scarce, are studied in greater detail. Representative sections in these deposits are sampled in 25- to 100-pound (11- to 45-kg) units from existing pit faces or from test pits. The samples are analysed for grain size distribution, and in some cases the Los Angeles abrasion and impact test, absorption, and Magnesium Sulphate soundness tests and petrographic analyses are carried out. Analyses are performed either in the laboratories of the Soils and Aggregates Section, Engineering Materials Office, Ontario Ministry of Transportation, or in the Geoscience Laboratories, Geoservices Section, Ontario Geological Survey.

The field data are supplemented by pit information on file with the Soils and Aggregates Section of the Ontario Ministry of Transportation. Data contained in these files include field estimates of the depth, composition and "workability" of deposits as well as laboratory analyses of the physical properties and chemical suitability of the aggregate. Information concerning the development history of the pits and acceptable uses of the aggregate is also recorded. The locations of additional sources were obtained from records held by Regional and District Offices of the Ontario Ministry of Natural Resources. The cooperation of the above-named groups in the compilation of inventory data is gratefully acknowledged.

Aerial photographs at various scales are used to determine the continuity of deposits, especially in areas where information is limited. Water well records, held by the Ontario Ministry of the Environment, are used in some areas to corroborate deposit thickness estimates or to indicate the presence of buried granular material. These records are used in conjunction with other evidence.

Topographic maps of the National Topographic System, at a scale of 1:50 000, are used as a compilation base for the field and office data. The information is then transferred to a base map, also at a scale of 1:50 000, prepared by the Cartography Section of the Lands and Waters Group, Ontario Ministry of Natural Resources, for presentation in the report.

RESOURCE TONNAGE CALCULATION TECHNIQUES

SAND AND GRAVEL RESOURCES

Once the interpretative boundaries of the aggregate units have been established, quantitative estimates of the possible resources available can be made. Generally, the volume of a deposit can be calculated if its areal extent and average thickness are known or can be estimated. The computation methods used are as follows. First, the area of the deposit, as outlined on the final base map, is calculated in acres. The thickness values used are an approximation of the deposit thickness, based on the face heights of pits developed in the deposit or on subsurface data such as test holes and water well logs. Original tonnage values can then be calculated by multiplying the volume of the deposit by 2500 (the density factor). This factor is approximately the number of tons in a one-foot (0.3 m) thick layer of sand and gravel, one acre (0.4 ha) in extent, assuming an average density of 110 pounds per cubic foot (1766 kg per cubic metre).

Tonnage = Area x Thickness x Density Factor

Tonnage calculated in this manner must be considered only as an estimate. Furthermore, such tonnages represent amounts that existed prior to any extraction of material (i.e., original tonnage) (Table 1, Column 4).

The Selected Sand and Gravel Resource Areas in Table 3 are calculated in the following way. Two successive subtractions are made from the total area. Column 3 accounts for the number of acres unavailable because of the presence of permanent cultural features and their associated setback requirements. Column 4 accounts for those areas that have previously been extracted (e.g., wayside and abandoned pits are included in this category). The remaining figure is the area of the deposit currently available for extraction (Column 5). The available area is then multiplied by the estimated deposit thickness and the density factor (Column 5 x Column 6 x 2500) to give an estimate of the sand and gravel tonnage (Column 7) presently available for extractive development and/or resource protection.

Reserve estimates are calculated for deposits of primary significance. Reserve estimates for deposits of secondary and tertiary significance are not calculated in Table 3, however the aggregate potential of these deposits is discussed in the report.

UNITS AND DEFINITIONS

Although most of the measurements and other primary data available for resource tonnage calculations are given in Imperial units, Metric units have also been given in the text and on the tables which accompany the report. The Metric equivalent of the data is shown in brackets after or directly below the corresponding Imperial figures. Data are generally rounded off in accordance with the Ontario Metric Practice Guide (Metric Committee 1975).

The tonnage estimates made for sand and gravel deposits are termed possible resources (see Glossary, Appendix B) in accordance with terminology of the Ontario Resource Classification Scheme (Robertson 1975, p.7) and with the Association of Professional Engineers of Ontario (1976).

Part II — Data Presentation and Interpretation

For each map area there are two maps, each portraying a different aspect of the aggregate resources in the report area. Maps 1A, 1B and 1C, "Distribution of Sand and Gravel Deposits", give a comprehensive inventory of the sand and gravel resources in the report area. Maps 2A, 2B and 2C, "Selected Sand and Gravel Resource Areas", show those deposits which are considered to represent the largest and/or highest quality resources in the area.

MAPS 1A, 1B and 1C: DISTRIBUTION OF SAND AND GRAVEL DEPOSITS

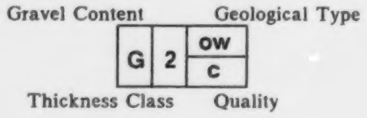
Maps 1A, 1B and 1C are derived from existing surficial geology maps of the area or from aerial photograph interpretation in areas where surficial mapping is incomplete. The maps show the extent and quality of sand and gravel deposits within the study area and the present level of extractive activity.

On the maps, gravel deposits are indicated by dark brown shading while sand deposits are shaded light brown. The present level of extractive activity is also indicated. Sand and gravel pits are identified by a numbered dot on Maps 1A, 1B and 1C and described in Table 2. Each description notes the location and estimated face height of the pit as well as the estimated percentage gravel it contains. Test hole locations appear on Maps 1A, 1B and 1C as a point symbol and are described in Table 5. Geophysics lines are shown on Maps 1A, 1B and 1C by a line symbol and are interpreted in Table 6.

Maps 1A, 1B and 1C also present a summary of available information related to the quality of aggregate contained in all the known aggregate deposits in the study area. Much of this information is contained in the symbols which are found on the maps. The Deposit Symbol appears for each mapped deposit and summarizes important genetic and textural data. The Texture Symbol is a circular proportional diagram which displays the grain size distribution of the aggregate in areas where bulk samples were taken.

DEPOSIT SYMBOL

The Deposit Symbol is similar to those used in soil mapping and land classification systems commonly in use in North America. The components of the symbol indicate the gravel content, thickness of material, origin (type), and quality limitations for every deposit shown on Maps 1A, 1B and 1C. These components are illustrated by the following example:



This symbol identifies an outwash deposit 10 to 20 feet (3 to 6 m) thick containing more than 35 percent gravel. Excess silt and clay may limit uses of the aggregate in the deposit.

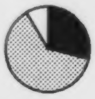
The "gravel content" and "thickness class" are basic criteria for distinguishing different deposits. The "gravel content" symbol is an upper case "S" or "G". The "S" indicates that the deposit is generally "sandy" and that gravel-sized aggregate (greater than 4.75 mm) makes up less than 35 percent of the whole deposit. "G" indicates that the deposit contains more than 35 percent gravel.

The "thickness class" indicates a depth range which is related to the potential resource tonnage for each deposit. Four thickness class divisions have been established as shown in the legend for Maps 1A, 1B and 1C.

Two smaller sets of letters, divided from each other by a horizontal line, follow the thickness class number. The upper series of letters identifies the geologic deposit type (the types are summarized with respect to their main geologic and extractive characteristics in Appendix C) and the lower series of letters identifies the main quality limitations that may be present in the deposit as discussed in the next section.

TEXTURE SYMBOL

The Texture Symbol provides a more detailed assessment of the grain size distribution of material sampled during field study. These symbols are derived from the information plotted on the aggregate grading curves found in the report. The relative amounts of gravel, sand, and silt and clay in the sampled material are shown graphically in the Texture Symbol by the subdivision of a circle into proportional segments. The following example shows a hypothetical sample consisting of 30 percent gravel, 60 percent sand, and 10 percent silt and clay:



MAPS 2A, 2B and 2C: SELECTED SAND AND GRAVEL RESOURCE AREAS

Maps 2A, 2B and 2C are interpretative maps derived from an evaluation of the deposits shown on Maps 1A, 1B and 1C. The deposits identified on Maps 2A, 2B and 2C are those which are considered to be important in ensuring an adequate resource base for the future.

All the selected sand and gravel resource areas are first delineated by geological boundaries and then classified into three levels of significance: primary; secondary; and tertiary. Each area of primary significance is given a deposit number and all such deposits are shown by dark red shading on Maps 2A, 2B and 2C.

Selected Sand and Gravel Resource Areas of primary significance are not permanent, single land use units. They represent areas in which a major resource is known to exist, and may be reserved wholly or partially for extractive development and/or resource protection.

Deposits of secondary significance are indicated by light red shading on Maps 2A, 2B and 2C. Such deposits are believed to contain significant amounts of sand and gravel. Although deposits of secondary significance are not considered to be the "best" resources in the report area, they may contain large quantities of sand and gravel and should be considered part of the aggregate supply of the area.

Areas of tertiary significance are outlined on the map by a solid line but have no shading. They are not considered to be important resource areas because of their low available resources, or because of possible difficulties in extraction. Such areas may be useful for local needs but are unlikely to support large-scale development.

The process by which deposits are evaluated and selected involves the consideration of two sets of criteria. The main selection criteria are site specific, related to the characteristics of individual deposits. Factors such as deposit size, aggregate quality, and deposit location and setting are considered in the selection of those deposits best suited for extractive development. A second set of criteria involves the assessment of local aggregate resources in relation to the quality, quantity, and distribution of resources in the region in which the report area is located. The intent of such a process of evaluation is to ensure the continuing availability of sufficient resources to meet possible future demands.

SITE SPECIFIC CRITERIA

Deposit Size

Ideally, selected deposits should contain available sand and gravel resources large enough to support a commercial pit operation using a stationary or portable processing plant. In practice, much smaller deposits may be of significant value depending on the overall reserves in the rest of the project area. Generally, deposits in Class 1 (greater than 20 feet (6 m) thick), and containing more than 35 percent gravel are considered to be most favourable for commercial development. Thinner deposits may be valuable in areas with low total resources.

Aggregate Quality

The limitations of natural aggregates for various uses result from variations in the lithology of the particles composing the deposit, and from variations in the size distribution of these particles.

Four indicators of the quality of aggregate may be included in the deposit symbols on Maps 1A, 1B and 1C. They are: gravel content (G or S); fines (C); oversize (O); and lithology (L).

Three of the quality indicators deal with grain size distribution. The gravel content (G or S) indicates the suitability of aggregate for various uses. Deposits containing at least 35 percent gravel in addition to a minimum of 20 percent material greater than the 26.5 mm sieve are considered to be the most favourable extractive sites, since this content is the minimum from which crushed products can be economically produced.

Excess fines (high silt and clay content) may severely limit the potential use of a deposit. Fines content in excess of 10 percent may impede drainage in road sub-base aggregate and render it more susceptible to the effects of frost action. In asphalt aggregate, excess fines hinder the bonding of particles. Deposits known to have a high fines content are indicated by a "C" in the quality portion of the Deposit Symbol.

Deposits containing more than 20 percent oversize material (greater than 4 inches (10 cm) in diameter) may also have use limitations. The oversize component is unacceptable for all concrete aggregate and for road-building aggregate, so it must be either crushed or removed during processing. Deposits known to have an appreciable oversize component are indicated by an "O" in the quality portion of the Deposit Symbol.

Another indicator of the quality of an aggregate is lithology. Just as the unique physical and chemical properties of bedrock types determine their value for use as crushed rock, so do various lithologies of particles in a sand and gravel deposit determine its suitability for various uses. The presence of objectionable lithologies such as chert, siltstone, and shale, even in relatively small amounts, can result in a reduction in the quality of an aggregate, especially for high quality uses such as concrete and asphalt. Similarly, highly weathered, very porous and friable rock can restrict the quality of an aggregate. Deposits known to contain objectionable lithologies are indicated by an "L" in the quality component of the Deposit Symbol.

If the Deposit Symbol shows either "C", "O", or "L" or any combination of these indicators, the quality of the deposit is considered to be reduced for some uses of the aggregate. No attempt is made to quantify the degree of limitation imposed. Assessment of the four indicators is made from published data, from data contained in files of both the Ontario Ministry of Transportation (MTO) and the Engineering and Terrain Geology Section of the Ontario Geological Survey, and from field observations.

Quality data may also appear in Table 7, where the results of MTO quality tests are listed by test type and sample location. The types of tests conducted and the test specifications are explained in Appendixes B and D, respectively.

Analyses of unprocessed samples obtained from test holes, pits or sample sites are plotted on grain size distribution graphs. On the graphs are the Ontario Ministry of Transportation's gradation specification envelopes for aggregate products: Granular Base Course A, B and C; Hot-Laid Asphaltic Sand Nos. 1,2,3,4, and 8; and concrete sand. By plotting the gradation curves with respect to the specification envelopes, it can be determined how well the unprocessed sampled material meets the criteria for each product. These graphs, called Aggregate Grading Curves, follow the tables in the report.

Location and Setting

The location and setting of a resource area has a direct influence on its value for possible extraction. The evaluation of a deposit's setting is made on the basis of natural and man-made features which may limit or prohibit extractive development.

First, the physical context of the deposit is considered. Deposits with some physical constraint on extractive development, such as thick overburden or high water table, are less valuable resource areas because of the difficulties involved in resource recovery. Second, permanent man-made features, such as roads, railways, powerlines, and housing developments, which are built on a deposit, may prohibit its extraction. The constraining effect of legally required setbacks surrounding such features is included in the evaluation. A quantitative assessment of these constraints can be made by measurement of their areal extent directly from the topographic maps. The area rendered unavailable by these features is shown for each resource area in Table 3 (Column 3).

The assessment of sand and gravel deposits with respect to local land use and to private land ownership is an important component of the general evaluation process. These aspects of the evaluation process are not considered further in this report, but readers are encouraged to discuss them with personnel of the pertinent District Office of the Ontario Ministry of Natural Resources.

REGIONAL CONSIDERATIONS

In selecting sufficient areas for resource development, it is important to assess both the local and the regional resource base, and to forecast future production and demand patterns.

Some appreciation of future aggregate requirements in an area may be gained by assessing its present production levels and by forecasting future production trends. Such an approach is based on the assumptions that production levels in an area closely reflect the demand and that the present production "market share" of an area will remain roughly at the same level.

The aggregate resources in the region surrounding a project area should be assessed in order to properly evaluate specific resource areas and to adopt optimum resource management plans. For example, an area that has large resources in comparison to its surrounding region constitutes a regionally significant resource area. Areas with high resources in proximity to large demand centres, such as metropolitan areas, are special cases.

Although an appreciation of the regional context is required to develop comprehensive resource management techniques, such detailed evaluation is beyond the scope of this report. The selection of resource areas made in this study is based primarily on geological data or on considerations outlined in preceding sections.

BEDROCK RESOURCES

The Precambrian Shield rocks in northern Ontario are generally more complex and variable than the Paleozoic rocks of southern Ontario. They often show wide variations in mineralogy, texture (grain size), joint patterns and degree of weathering, even within specific rock types and over relatively short distances. As these factors are considered important in determining the suitability of the bedrock for use as aggregate, the aggregate potential may also vary considerably from location to location.

Careful selection is especially important if the bedrock is to be used as concrete aggregate. Deleterious chemical reactions may develop in the concrete which can lead to its eventual deterioration. Fortunately, these chemical reactions should not influence the use of bedrock-derived aggregate for such uses as road-base material. However, highly weathered, very porous and friable rock should be avoided for all uses.

For these reasons, no specific bedrock resources have been selected for resource protection. A summary of the bedrock resources on a regional level is included in the Bedrock Geology and Resource Potential section.

Part III — Assessment of Aggregate Resources in the Parry Sound to French River Area

LOCATION AND POPULATION

The report area includes 15 geographic townships and one unsurveyed area located in the District of Parry Sound in northern Ontario. The area extends from the vicinity of the town of Parry Sound to the French River, along the eastern shore of Georgian Bay. It occupies a total of approximately 940,000 acres (380 000 ha). The area is covered by the Delamere (41 I/2), Key Harbour (41 H/15), Lake Joseph (31 E/4), Magnetawan (31 E/12), Naiscoot River (41 H/10), Noelville (41 I/1), Noganosh Lake (41 H/16), Parry Sound (41 H/8), Pointe Au Baril Station (41 H/9), Sans Souci (41 H/1) and Orrville (31 E/5) map sheets of the National Topographic System, at a scale of 1:50 000.

Because of the large extent of the project area, it has been divided into three separate map areas for the purposes of this report. The Byng Inlet Map Area consists of the Key Harbour Area, and Henvey, Mowat, Blair, Wallbridge and Brown geographic townships. Harrison, Shawanaga, Carling and Ferguson geographic townships form the Pointe Au Baril Station Map Area and the Parry Sound Map Area includes McDougall, Cowper, Foley, Christie, Conger and Humphrey geographic townships.

A number of the geographic townships in the report area, singly or in combination, form incorporated township municipalities. Carling, McDougall, Foley, and Christie geographic townships form individual township municipalities with the same names. Humphrey geographic township and a small part of Conger geographic township are included in Humphrey Township Municipality. Cowper geographic township, along with parts of Conger, Harrison and Shawanaga geographic townships, have been incorporated into The Archipelago Township Municipality. The remaining geographic townships (Henvey, Mowat, Blair, Brown, Wallbridge, Ferguson and parts of Harrison and Shawanaga) are unincorporated. The Key Harbour Area is unincorporated and unsurveyed. The location of the municipal and geographic townships and their relationships, and the location of the Key Harbour Area are shown in Figure 2.

In 1985, the permanent population of the municipalities in the District of Parry Sound was 29,498, of which approximately 40 percent reside within the report area (Ontario Ministry of Municipal Affairs 1988). The population in the municipalities within the report area has increased about 8 percent between 1972 and 1985 (Ontario Ministry of Treasury, Economics and Intergovernmental Affairs 1974; Ontario Ministry of Municipal Affairs 1988). The town of Parry Sound, the major population centre within the area, had 5813 permanent residents in 1985 (Ontario Ministry of Municipal Affairs 1988). It is also a centre of trade, retail, recreation and industry for the permanent and seasonal populations from the surrounding areas. Smaller centres in the report area include the village of Rosseau, and the communities of Britt, Byng Inlet, Pointe Au Baril Station, Nobel, Orrville and Humphrey. Major activities in the area include tourism and forestry. Farming is also an important activity in Christie and Humphrey geographic townships.

The natural beauty of the area from Parry Sound to the French River makes it a prime tourism and recreation location in Ontario. Parry Sound is the gateway to the 30,000 islands situated in Georgian Bay. Numerous cottages have been developed on these islands, and along the shores of the bay. Cottages also line the shores of many inland lakes and rivers in the area. Major inland waterbodies and watercourses include Lake Rosseau, Lake Joseph, and the French, Pickerel and Magnetawan Rivers. The highest concentration of cottage development is within the southern part of the report area because it is close to population centres to the south. Grundy Lake, Sturgeon Bay, Oastler Lake, and Killbear Provincial Parks are recreational centres in the area. Estimates for the seasonal population of the area range from three to four times the permanent population. Many permanent residents are involved in activities supported by the tourism industry.

The combination of a large seasonal population and a steadily growing permanent population has resulted in a strong demand for aggregate. Aggregate is required for road-building and general construction uses. Construction of cottage and forest access roads, as well as residential and cottage dwellings, appears to be an ongoing activity in the area. Widening and maintenance of major highways, including King's Highway 69, also requires the use of aggregate.

Much of the report area flanks King's Highway 69 which is the major transportation route in the area. Highway 69 links the area to population centres in the north and the south. King's Highways 69B, 124 and 141, and Secondary Highways 518, 522, 526, 529, 529A, 559, 612, 632, 644 and 645 are also important transportation linkages in the area. Township roads provide access in the township municipalities. Cottage and forest access roads are also common in the area. Generally, accessibility decreases as the distance from highways and population centres increases. Much of the project area, es-

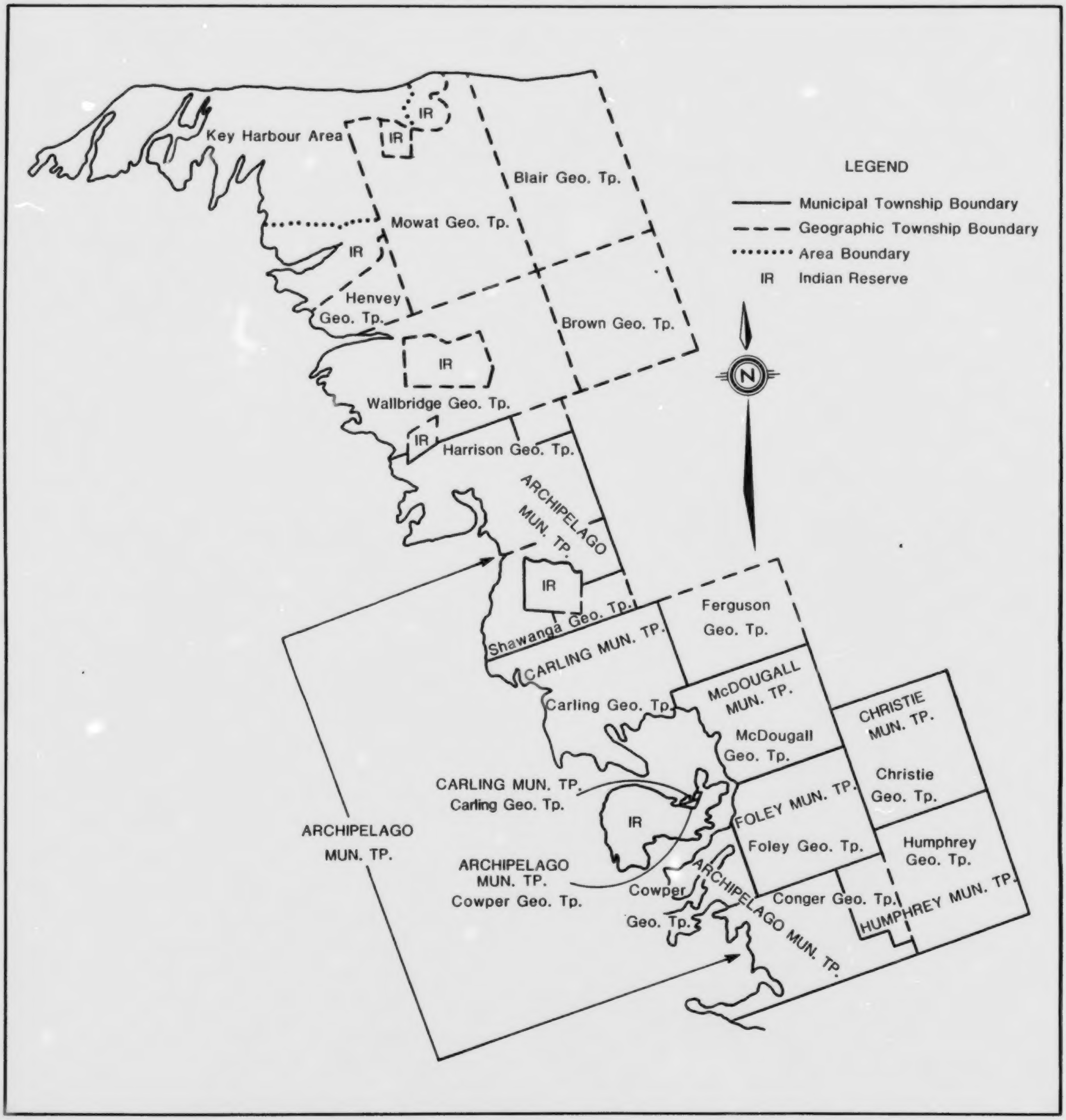

Key Harbour Area
IR
IR
Blair Geo. Tp.
Mowat Geo. Tp.
IR
Henvey Geo. Tp.
Brown Geo. Tp.
IR
Wallbridge Geo. Tp.
IR
Harrison Geo. Tp.
ARCHIPELAGO MUN. TP.
IR
Shawanga Geo. Tp.
Ferguson Geo. Tp.
CARLING MUN. TP.
Carling Geo. Tp.
McDOUGALL MUN. TP.
McDougall Geo. Tp.
CHRISTIE MUN. TP.
Christie Geo. Tp.
CARLING MUN. TP.
Carling Geo. Tp.
IR
FOLEY MUN. TP.
Foley Geo. Tp.
Humphrey Geo. Tp.
ARCHIPELAGO MUN. TP.
ARCHIPELAGO MUN. TP.
Cowper Geo. Tp.
Cowper Geo. Tp.
ARCHIPELAGO MUN. TP.
Conger Geo. Tp.
HUMPHREY MUN. TP.
N
LEGEND
Municipal Township Boundary
Geographic Township Boundary
Area Boundary
IR Indian Reserve

FIGURE 2: Geographic Areas and Municipal Organization in the Parry Sound to French River Area, Scale 1:660 000.

pecially in the north, is presently inaccessible by road. In addition to road access, lines of the Canadian Pacific Railway and Canadian National Railways traverse the area.

PHYSIOGRAPHY AND SURFICIAL GEOLOGY

The glacial deposits in the report area are underlain by Precambrian bedrock, which also occurs at the ground surface throughout much of the report area. The bedrock in the area exhibits the typical 'rock knob' 'rock ridge', and 'rock plain' topography of the Canadian Shield (Gartner 1980; Mollard 1980a, 1980b, 1980c, 1980d). The project area is located within the Georgian Bay Fringe physiographic region, as described by Chapman and Putnam (1984). The ridges and knobs are typically covered by only very shallow soil, or are bare. Large tracts of bare bedrock are especially common near the shores of Georgian Bay.

Glacial and post-glacial materials make up the remainder of the land surface. These deposits are related to the last major advance and melting of a continental ice sheet during the Late Wisconsinan Substage of the Pleistocene Epoch, informally known as the "Great Ice Age". During this substage, a discontinuous cover of till was deposited sporadically within the project area by glacial ice which advanced in a south-southwest direction (Kor 1987; Kor and Miller 1987a, 1987b). This sandy till generally exists as a thin veneer over bedrock. Till is usually not well suited for aggregate use as it often contains excess fines and abundant oversize clasts. However, it may be a suitable source of fill in some localities.

Several deposits of ice-contact stratified drift were deposited in close proximity to the ice front as the ice front melted to the north. Most of these deposits occur as small patches of sand and gravel flanking the south side of bedrock knobs, and contain limited resources of aggregate. However, a number of these deposits are of sufficient size to be considered important aggregate sources in the report area. Ice-contact features are relatively more common in the northern part of the report area.

As the ice front melted back about 11 500 years BP, the land surface was submerged beneath the waters of glacial Lake Algonquin (Kor and Miller 1987a, 1987b). Subaqueous fans were formed where meltwaters entered the lake directly from tunnels under the ice (Rust and Romanelli 1975; Kor and Miller 1987a, 1987b). The subaqueous fans in the area occur either as isolated lobe-shaped features or as larger, continuous sedimentary bodies formed by the joining together of several lobes. The continuous bodies are often situated within or along the edges of south to southwest trending bedrock depressions. Typically the fans consist of silty fine to coarse sand and may contain minor amounts of fine gravel. The aggregate in these features tends to become finer near the surface and the fans may be capped by a thin layer of silt and clay. Gravel, where present in these features, is usually concentrated at depth. Subaqueous fan deposits are the major sources of aggregate in the study area.

The subaqueous fans were deposited beneath glacial lake waters, and as a result, glaciolacustrine sediments are usually closely associated with the fan material. Consequently, the dual designation of lacustrine plain-subaqueous fan (LP-SF) has been given to the subaqueous fans on Maps 1A, 1B and 1C.

In the deep waters of glacial Lake Algonquin, and subsequently glacial Lake Nipissing, silt and clay were deposited. Glaciolacustrine plain sediments, consisting predominantly of silty fine to medium sand, were laid down in the shallower parts of the lakes. These glaciolacustrine sands may be suitable for some low specification aggregate uses. Glaciolacustrine plain sediments are widespread throughout the report area.

As water levels lowered in the lakes, outwash material was deposited by water flowing within the Pickerel River valley and other minor bedrock lineaments. The outwash primarily consists of well stratified and uniformly bedded, medium to coarse sand. Although outwash is scarce in the area, the existing deposits may be valuable sources of local aggregate.

Erosional and depositional activities have been minimal since the disappearance of the ice sheets and lowering of lake waters to present day levels. Dune sand is locally abundant on glaciolacustrine deposits in Killbear Provincial Park (Kor and Miller 1987b). Organic deposits have developed in depressions in the land surface, and alluvium has been laid down along the courses of existing creeks and rivers.

EXTRACTIVE ACTIVITY

Numerous sand and gravel pits have been opened in the Parry Sound to French River Area. The pits are generally widely distributed, although they tend to be relatively more abundant close to highways and population centres. During field investigation, the pits were observed to be at various stages of development. Many of the pits had been worked recently, but several sites had been inactive for a considerable period of time. The aggregate available from the pits is generally suitable for uses including road sub-base, septic beds and fill. Higher specification sand products may be produced from some sources. Crushable gravel is available from only an extremely limited number of pits in the area.

Several quarries have been established in the area in response to the lack of crushable gravel. Most of these quarries are situated near Parry Sound or along King's Highway 69 and Secondary Highway 522, and usually occur at regularly spaced intervals between 6 and 12 miles (10 and 19 km) apart. The quarries are operated mainly on a demand basis. Three quarries were operating at the time of field investigation to supply crushed stone for passing lane construction along King's Highway 69, and for other general construction purposes.

Aggregate is also produced in the area by dredging. Aggregate is dredged from the waters of Georgian Bay to supply cottage construction needs along the northeastern shore of the bay. Sand and gravel is also dredged from beneath the water table in the floor of several pits.

Significant amounts of aggregate are also imported into the project area to meet demands for high specification aggregates, which are generally lacking. Many cottage-access roads are constructed using local sandy aggregate as a sub-base course and imported crushed stone as surfacing. Many bridge structures are also constructed using imported aggregates.

SELECTED SAND AND GRAVEL RESOURCE AREAS

Maps 1A, 1B and 1C for the Byng Inlet, Pointe Au Baril Station and Parry Sound Map Areas, respectively, indicate the deposits which contain granular materials. These deposits occupy a total of approximately 31,000 acres (12 500 ha) and contain an original resource tonnage of 490 million tons (445 million tonnes). Many of the deposits have limited potential for extraction because of the restricted amount of available resources, poor quality of the material, and/or poor accessibility. Consequently, only the most significant sources have been suggested for possible resource protection. The aggregate resources in parts of the project area have been previously described by Gartner (1980), Mollard (1980a, 1980b, 1980c, 1980d), and Kor and Miller (1987a, 1987b).

In general, the project area contains only limited resources of sand and gravel. These resources are especially scarce in the northern part of the area and in areas lying close to the shores of Georgian Bay. Deposits in these locations are usually small, isolated bodies containing material suitable for pit-run uses. In the northern area, large tracts of land contain little or no aggregate resources. Therefore, aggregate may have to be transported lengthy distances to supply construction needs in certain areas. The southern part of the project area contains relatively more aggregate resources. These resources consist primarily of sandy aggregate suitable for low specification applications. Supplies of crushable gravel are lacking throughout the whole project area.

As a result of the shortage of sand and gravel in the area, any deposit potentially capable of producing at least low specification aggregates such as Granular Base Course (GBC) C and fill in locally significant quantities was considered for possible resource protection. The deposits selected at the primary and secondary levels of significance are typically less deep than selected deposits in many other areas of Ontario. Average thicknesses of the selected deposits in this project area generally range from 5 to 15 feet (1.5 to 5 m) thick, with bedrock and/or the water table likely to be encountered within 15 feet (5 m) of the surface at many locations.

Most deposits selected for possible resource protection in the report area are subaqueous fans. The aggregate available from the fans may exhibit wide variations in grain size distribution. The fans typically consist of material ranging from silty fine sand to coarse sand with minor amounts of fine gravel. Varying amounts of silt and clay may be associated with these deposits, especially at the surface. Sandy gravel may be locally abundant in some fan deposits. This gravel is often concentrated in the lower levels of the pits, and in several sources it is dredged from beneath the water table. Because the subaqueous fans were deposited beneath glacial lake waters, glaciolacustrine sediments are usually closely associated with the fan material. Consequently, the "geological type" indicators for the fan features on Maps 1A, 1B and 1C have been given the dual designation of lacustrine plain-subaqueous fan (LP-SF).

Several ice-contact and glaciolacustrine plain deposits have also been selected at the primary and secondary levels of significance. Material exposed in the ice-contact deposits varies from fine sand to coarse gravel suitable for crushing. Ice-contact material has been the primary source of aggregate for the construction of resource access roads in the northern part of the project area. Locally significant resources of fine to medium sand may be available from the selected glaciolacustrine plain deposits.

The Selected Sand and Gravel Resource Areas of Primary Significance occupy a total available area of 2550 acres (1030 ha). They contain possible sand and gravel resources of approximately 79 million tons (72 million tonnes). The selected areas contain most of the potential resources of quality sand and gravel in the study area.

BYNG INLET MAP AREA

SELECTED SAND AND GRAVEL RESOURCE AREAS (MAP 2A)

Selected Sand and Gravel Resource Area 1

Selected Sand and Gravel Resource Area 1 is a subaqueous fan deposit located near the Pickerel River in northern Mowat geographic township. The deposit is a northeast to southwest trending ridge. Local relief of the ridge varies from over 30 feet (9 m) at the Pickerel River to 12 feet (4 m) in the south. The western edge of the ridge abuts bedrock.

Pit nos. 5 and 6 have been developed in Area 1. Between 5 and 8 feet (1.5 and 2 m) of fine to medium sand is exposed in the pits. The material appears best suited for low specification aggregate uses. The deposit is presently only readily accessible via water, and the pits have been opened largely to supply local cottage construction needs. Further development in the area may increase the importance of this resource.

Resource Area 1 occupies 41 acres (17 ha). Cultural constraints and previous extraction reduce the area currently available to 35 acres (14 ha). Assuming an average deposit thickness of 15 feet (5 m), the available sand and gravel resources are estimated to be 1.3 million tons (1.2 million tonnes).

Selected Sand and Gravel Resource Area 2

An outwash deposit in northeastern Mowat geographic township has been selected at the primary level of significance. Three pits are located in this feature. Five feet (1.5 m) of horizontally bedded coarse sand with minor amounts of very fine gravel is exposed in pit no. 7. This material was sampled and contained 6 percent gravel, 93 percent sand and 1 percent fines (Figure 4a). Pit nos. 8 and 9, located in the eastern part of the deposit, are presently near depletion. Granular sub-base and fill may be the most readily produced aggregate products from the deposit. Fines may have to be added to act as a binder to ensure proper compaction of the material for use as sub-base.

Resource Area 2 occupies 65 acres (26 ha), of which 40 acres (16 ha) are currently available for extraction. Assuming an average deposit thickness of 6 feet (2 m), aggregate resources are considered to be 0.6 million tons (0.5 million tonnes). A forest access road provides access to the area.

Selected Sand and Gravel Resource Area 3

Selected Sand and Gravel Resource Area 3 is an ice-contact deposit situated in eastern Mowat geographic township. It is a roughly east to west trending feature which flanks the northern edge of a bedrock controlled valley. The southern slopes of this feature rise between 15 and 25 feet (5 and 8 m) above the surrounding terrain.

Pit no. 10, test hole PS-TH-3 and seismic line PS-GT-1 provide subsurface information for this deposit. Faces in the pit expose 20 to 25 feet (6 to 8 m) of medium to coarse sand with steeply inclined layers of fine gravel. A sample taken from the pit consisted of 31 percent gravel (Figure 4a). Similar quality aggregate was observed in the test hole, which uncovered approximately 7 feet (2 m) of gravelly sand beneath 3 feet (1 m) of fine to coarse gravel. The lower sand unit was sampled and contained 28 percent gravel (PS-TH-3a and 3b, Figure 8a). Samples taken from both the test hole and pit indicate that the aggregate may be suitable for GBC B and C, as well as some asphaltic sand products. The aggregate tends to be so clean (i.e., lacks fines) that fines may have to be added to act as a binder to ensure proper compaction of the material for GBC B and C. Data for seismic line PS-GT-1 indicate 26 feet (7.9 m) of sand and gravel overlies bedrock.

Resource Area 3 is considered a valuable future resource as it contains the largest quantities of quality sand and gravel remaining in the township. It is also readily accessible via the existing road network. The resource area occupies approximately 75 acres (30 ha), of which 70 acres (28 ha) are currently available for extraction. Assuming an average deposit thickness of 20 feet (6 m), sand and gravel resources are estimated to total 3.5 million tons (3.2 million tonnes).

Selected Sand and Gravel Resource Area 4

A subaqueous fan deposit located along Secondary Highway 522 in Mowat geographic township constitutes Selected Sand and Gravel Resource Area 4. Two pits have been established south of the highway in this flat-lying feature. Sand resources in these pits are depleted, and have been extracted to bedrock. Most remaining aggregate resources in the deposit lie north of the highway. Test hole PS-TH-4 was excavated in this area. Fine to medium sand was uncovered to a depth of 7.7 feet (2.4 m) in the test hole. This sand was interbedded with a 0.5-foot (0.2 m) thick silt layer and was underlain by bedrock. A sample of the sand consisted of 93 percent sand and 7 percent fines and appears best suited for use as fill (Figure 9a). Coarser sands may be available from the northeastern part of the deposit. Three feet (1 m) of medium to coarse sand with minor amounts of fine gravel was encountered in several hand augered test holes.

Resource Area 4 is a potential source of at least low specification aggregate, and is close to highway access. It occupies 120 acres (49 ha), of which 100 acres (40 ha) are considered available for extraction. Assuming an average deposit thickness of 8 feet (2 m), aggregate resources are approximately 2 million tons (1.8 million tonnes).

Selected Sand and Gravel Resource Area 5

Selected Sand and Gravel Resource Area 5 is an ice-contact deposit situated in western Blair geographic township. Two pits are located in this mound-shaped feature. Between 10 and 15 feet (3 and 5 m) of predominantly medium to coarse sand is exposed in the pits. Boulders are common in the upper 2 feet (1 m) of the pit faces. The most readily produced aggregate products from the deposit likely include GBC C and fill. Bedrock may underlie the deposit at variable depths.

Resource Area 5 is readily accessible. It occupies 42 acres (17 ha), of which 35 acres (14 ha) are currently available for extraction. Based on an average thickness estimate of 12 feet (4 m), sand resources are approximately 1 million tons (0.9 million tonnes).

Selected Sand and Gravel Resource Area 6

A subaqueous fan deposit in eastern Blair geographic township has been selected at the primary level of significance. No pits have been opened in this flat-lying feature but three hand augered test holes in the eastern portion of the deposit indicate the presence of 3 feet (1 m) of fine to medium sand with minor amounts of very fine gravel. This material is potentially suitable for at least low specification aggregates. Further subsurface investigation is required to fully determine the total resource potential of Area 6.

Approximately 55 acres (22 ha) are available for extraction in Resource Area 6. Assuming an average deposit thickness of 8 feet (2 m), resource tonnage is estimated to total 1.1 million tons (1 million tonnes). The resource area is currently inaccessible by road.

Selected Sand and Gravel Resource Area 7

Selected Sand and Gravel Resource Area 7 is located between Harris Lake and King's Highway 69 in southern Wallbridge geographic township. Three pits have been developed within this relatively flat deposit. Faces in pit nos. 53, 54 and 55 expose between 2 and 12 feet (1 and 4 m) of predominantly fine glaciolacustrine sand. This material is suitable for low grade aggregate uses such as fill. These fine sands may, however, overlie and mask coarser aggregate. This relationship was observed in pit no. 54. In one section of the pit, 2 feet (1 m) of fine-grained glaciolacustrine material overlies 4 feet (1.2 m) of medium to coarse sand with fine gravel. The lower, coarser unit is considered to be of subaqueous fan origin. Dredging operations in the floor of the pit have uncovered additional quantities of coarser material from below the water table. This material is a clean, gravelly sand which appears suitable for uses including GBC B and C. Further subsurface investigation may reveal additional resources of gravelly sand in the resource area.

Geophysical traverse lines PS-GT-2 to PS-GT-5 were conducted in Resource Area 7. The results of these lines indicate that between 10 and 34 feet (3 and 10 m) of aggregate overlies bedrock. The presence of the water table at 7 and 12 feet (2.1 and 3.7 m) is indicated by seismic lines PS-GT-3 and PS-GT-4, respectively.

Resource Area 7 occupies approximately 105 acres (42 ha). Cultural setbacks and previous extraction reduce the area currently available to 70 acres (28 ha). Assuming an average deposit thickness of 12 feet (4 m), aggregate resources are estimated to be 2.1 million tons (1.9 million tonnes).

Selected Sand and Gravel Resource Area 8

A subaqueous fan deposit in southeastern Wallbridge geographic township constitutes Selected Sand and Gravel Resource Area 8. This flat-lying feature has been deposited within a northeast to southwest trending bedrock controlled valley. Pit no. 64 is located in the northern part of the deposit. Faces in the pit consist of 4 to 15 feet (1 to 5 m) of fine to medium sand with pockets of fine sandy gravel. This material appears well suited for pit-run uses. An 8-foot (2 m) thick silt and clay layer, exposed in one pit face, should be avoided during extraction. The aggregate may become finer in the southern part of the deposit. Test hole PS-TH-8 was excavated in this area and uncovered 10 feet (3 m) of very fine to medium sand with a 3-inch (8 cm) thick silt seam. This material was too fine for most usual aggregate applications (Figure 9a).

Factors which may limit the depth of operations in the deposit include the possible existence of a variable bedrock surface at depth, and a high water table. Bedrock was encountered on the floor of the pit and at depths between 14 and 21 feet (4.3 and 6.4 m) beneath seismic lines PS-GT-7 to PS-GT-9. Water was observed ponded on the pit floor and near the base of the test hole. The water table may also exist at depths between 4 and 8 feet (1.2 and 2.4 m) beneath the seismic lines.

Resource Area 8 totals 130 acres (53 ha), of which 125 acres (51 ha) are considered available for extraction. Based on an estimated deposit thickness of 8 feet (2 m), available resources are approximately 2.5 million tons (2.3 million tonnes). A forest access road provides access to the area.

Selected Sand and Gravel Resource Area 9

Selected Sand and Gravel Resource Area 9 consists of an ice-contact deposit located along the Still River in northeastern Wallbridge geographic township. Pit no. 65 has been established in this feature which flanks the south side of a bedrock ridge. The 12- to 25-foot (4 to 8 m) faces in this pit expose a 4- to 13-foot (1 to 4 m) thick upper unit consisting of medium to coarse sand with minor amounts of fine gravel. The aggregate in this unit appears well suited for pit-run uses. The sand overlies between 8 and 12 feet (2 and 4 m) of medium to coarse gravel. A sample of this lower gravel unit contained 66 percent gravel which appears to be well suited for crushing (Figure 7a). During field investigation aggregate was actively being extracted from the pit for forest access road development in the area.

Resource Area 9 occupies approximately 27 acres (11 ha). Previous extraction reduces the area currently available to 20 acres (8 ha). Assuming an average thickness of 20 feet (6 m), sand and gravel resources are estimated to be 1 million tons (0.9 million tonnes).

Selected Sand and Gravel Resource Area 10

Three ice-contact deposits have been selected at the primary level of significance in western Brown geographic township. They have been designated as Areas 10a to 10c on Map 2A. Areas 10a and 10b are considered to be potential sand sources. Pit no. 67 has been opened in Area 10a. Faces in the pit consist of 4 feet (1 m) of silt over 6 feet (2 m) of coarse sand with minor amounts of fine gravel. The lower sand unit was sampled and contained 3 percent gravel, 96 percent sand and 1 percent fines (Figure 7a). Although most of the upper silt layer should be removed prior to extraction of the underlying aggregate, silt may have to be added to the sands to act as a binder to ensure proper compaction for pit-run applications. Pit no. 69 has been opened in an east to west trending ridge in Area 10b. Five to six feet (1.5 to 2 m) of medium to coarse sand with an estimated 20 percent fine gravel overlies 4 to 5 feet (1.2 to 1.5 m) of silty fine to medium sand in the pit.

Gravel is the predominant material available from Area 10c. Subsurface information for the area is provided by pit no. 68 and a test pit excavated just west of the pit. The 5- to 8-foot (1.5 to 2 m) faces in pit no. 68 consist largely of fine to coarse gravel. The gravel content of these faces is estimated at between 35 and 55 percent. Ten to fifteen feet (3 to 5 m) of coarse gravel with abundant oversize clasts was observed in the test pit. The gravel exposed in the deposit appeared suitable for crushing. Water was observed on the floor of pit no. 68, and a high water table may limit extraction elsewhere in the deposit.

The ice-contact deposits occupy a total of 54 acres (22 ha), of which 51 acres (21 ha) are considered potentially available for extraction. Assuming an average thickness of 8 feet (2 m) for the deposits, aggregate resources are expected to be 1 million tons (0.9 million tonnes). A network of recently constructed forest access roads provides access to the deposits.

Resource Areas of Secondary Significance (Map 2A)

Two glaciolacustrine sand deposits have been selected as Resource Areas of Secondary Significance in Henvey geographic township. Five to eight feet (1.5 to 2 m) of medium sand is exposed in faces of pit no. 2 which has been developed in the northern deposit. This sand is generally acceptable for uses including GBC C and fill (Figure 4a), and is a potential source of blending sand. Test holes excavated by the Ontario Ministry of Transportation (MTO) in the vicinity of the pit encountered the water table at depths between 4 and 9 feet (1 and 3 m). Bedrock was observed in the floor of the pit. Medium sand is also revealed in the less than 5-foot (less than 1.5 m) faces of pit no. 3 in the southern deposit. Although the deposit is shallow, it has been selected because it is a potential source of blending sand in close proximity to a quarry (Quarry no. 1). Material has been extracted from the deposit and blended with screenings from quarry no. 1 for asphaltic sand use.

Six deposits are considered resources of secondary significance in Mowat geographic township. They include the ice-contact feature which adjoins Resource Area 3. Test holes PS-TH-1 and PS-TH-2 have been excavated to depths of 7.7 and 11.0 feet (2.4 and 3.4 m), respectively, in this deposit. Both test holes uncovered variable material ranging from silty fine sand to fine gravel. Samples taken from these excavations contained between 0 and 47 percent gravel (Figures 7a and 8a). Water was encountered at depths of 6.0 and 11.0 feet (1.8 and 3.4 m) in the test holes. Because of the variability of the material and presence of the water table, further subsurface investigation is recommended prior to pit development in the deposit. The subaqueous fan feature near Pakesley has been a traditional source of aggregate in the area. Products including GBC B and C, and winter sand have been produced from the deposit. Although previous extraction has limited the amount of aggregate available in the deposit, the remaining material is considered well suited for low specification uses. The remaining deposits selected at the secondary level in the township consist predominantly of glaciolacustrine fine to medium sand. This sand is suitable for low grade aggregate uses, and has been extracted from pit nos. 22, 23 and 24 for forest access road construction in the southeastern part of the township.

Secondary selections in Blair geographic township include six ice-contact features. Most of these features occur as isolated patches of sand and gravel flanking the south side of rock knobs. Although the deposits are of limited areal extent, they contain locally significant aggregate resources. Pit nos. 31 and 32 have been opened in two of these deposits in the northern part of the township. The pits generally expose a mixture of sand and fine gravel. Boulders are common in pit no. 31. Aggregate from these pits has been extracted for access road development in the area. The deposits in which pit nos. 38 and 47 have been established are gravel sources. Samples taken from the pits contained between 44 and 47 percent gravel (Figures 5a and 6a). The aggregate in pit no. 38 is potentially crushable. Selective extraction would be required, however, to avoid till and clay layers within the gravel. The gravel in pit no. 47 is generally too fine for crushing purposes. Sand is the predominant material available from the deposits in which pit nos. 45, 48 and 49 are located. Selective extraction measures may be required in the vicinity of pit no. 49 as test holes excavated by MTO in this area often exposed abundant silt seams within the sand.

Two glaciolacustrine deposits have also been selected as secondary resources in Blair geographic township. Pit nos. 30 and 37 have been opened in the features. Between 3 and 8 feet (1 and 2 m) of fine to medium sand is revealed in these pits. A sample taken from pit no. 30 consisted of 96 percent sand and 4 percent fines (Figure 5a).

An ice-contact feature and three glaciolacustrine deposits have been selected at the secondary level of significance in Wallbridge geographic township. The predominant material available from the glaciolacustrine deposit in which pit no. 52 has been excavated is fine sand. This material appears best suited for use as fill. The glaciolacustrine sand revealed in pit no. 59 has been used for access road development in the area. A test hole excavated northwest of the pit uncovered 6 feet (1.8 m) of silty fine to coarse sand with fine gravel over till and bedrock (PS-TH-6). Subsurface data is lacking for the glaciolacustrine deposit located north of Resource Area 8. Three feet (1 m) of gravelly sand and silty fine sand overlies bedrock in an excavation along the rail line in this deposit. The aggregate may, however, be thicker elsewhere in the feature and may represent a valuable future resource. Detailed subsurface investigation is recommended to determine aggregate thickness and quality in the undeveloped parts of the deposit. The ice-contact feature in the northern part of the township is expected to contain similar material as Primary Resource Area 9, but in smaller quantities.

Brown geographic township contains two ice-contact features which are classified as secondary resources. Subsurface information is presently lacking for these deposits. The northernmost deposit, however, was deposited in a similar geological environment as Primary Resource Area 9 and may have similar resource potential. Sand is likely available from the southernmost deposit.

B. POINTE AU BARIL STATION MAP AREA

SELECTED SAND AND GRAVEL RESOURCE AREAS (MAP 2B)

Selected Sand and Gravel Resource Area 11

Selected Sand and Gravel Resource Area 11 is a subaqueous fan deposit located in the northeastern corner of Shawanaga geographic township. Subsurface information for Area 11 is provided by test holes PS-TH-9 to PS-TH-11. The test holes were excavated to depths between 8.0 and 9.3 feet (2.4 and 2.8 m) and exposed predominantly medium sand. This material was sampled and contained 98 to 99 percent sand with 1 to 2 percent fines (PS-TH-9a, PS-TH-10a and PS-TH-11; Figures 13a and 14a). The medium sand may, however, overlie and mask coarser aggregate, which was the situation in test holes PS-TH-9 and PS-TH-10. Gravelly sand was revealed at the base of both test holes. Samples taken of this coarser aggregate contained between 20 and 21 percent gravel (PS-TH-9b and PS-TH-10b; Figure 13a).

Factors which may limit the depth of extraction in the deposit include the potential existence of a high water table and a variable bedrock surface at depth. The water table was encountered at depths of 6.4 and 9.0 feet (2.0 and 2.7 m) in test holes PS-TH-10 and PS-TH-11, respectively. The gravelly sand unit in test hole PS-TH-10 occurred completely below the water table. A small bedrock knob is exposed in the central part of the deposit. Although there may be limits on extraction depth, Area 11 is considered to be a valuable potential source of pit-run aggregate.

Resource Area 11 occupies 20 acres (8 ha) currently available for extraction. Assuming an average deposit thickness of 8 feet (2 m), aggregate resources are approximately 0.4 million tons (0.4 million tonnes). A bush trail provides access to the deposit.

Selected Sand and Gravel Resource Area 12

Selected Sand and Gravel Resource Area 12 consists of a subaqueous fan deposit in northeastern Shawanaga geographic township. This large, primarily flat feature contains considerable potential resources of aggregate. Pit no. 92 is the easternmost pit in the area. The 15-foot (5 m) faces in the pit reveal 3 feet (1 m) of fine sand overlying gravelly sand. This aggregate appears well suited for uses including granular sub-base and fill. Aggregate similar to that exposed in the pit may be available from the undeveloped areas within the deposit. Seismic lines PS-GT-11 to PS-GT-15 were run in these undeveloped areas and indicated the presence of between 11 and 42 feet (3.4 and 12.8 m) of aggregate over bedrock.

Pit nos. 95 to 97 are located in the western part of the resource area. Faces in the pits expose 6 to 20 feet (2 to 6 m) of fine to medium sand. Minor amounts of gravel and a 2-foot (0.6 m) thick silt and clay layer were also observed. Faces in pit nos. 93 and 94 have been partially rehabilitated.

Resource Area 12 occupies approximately 225 acres (91 ha). Cultural constraints and previous extraction reduce the area potentially available to 180 acres (73 ha). The existence of a deer wintering yard on the deposit may also restrict the availability of the aggregate. Assuming an average deposit thickness of 12 feet (4 m), aggregate resources are estimated to be 5.4 million tons (4.9 million tonnes). The resource area is readily accessible.

Selected Sand and Gravel Resource Area 13

A subaqueous fan deposit located along King's Highway 69 in northern Shawanaga geographic township has been selected at the primary level of significance. One pit has been developed in Resource Area 13. The 5- to 10-foot (1.5 to 3 m) faces in pit no. 100 consist of variable material. In one face, up to 4 feet (1 m) of coarse gravel overlies 6 feet (2 m) of fine to coarse sand. One-foot (0.3 m) thick seams of medium to coarse gravel and silty fine sand may be common in the lower sand unit. A sample taken from this unit contained 20 percent gravel, 76 percent sand and 4 percent fines (Figure 11a). The aggregate in the pit is considered suitable for granular sub-base applications. Selective extraction measures would likely be required because of aggregate variability.

MTO has excavated six test holes in the vicinity of the pit. These test holes revealed largely sand with pockets of silt and till, as well as areas where bedrock is within 4 feet (1 m) of the surface. Because of the variability of the bedrock surface and aggregate, detailed sub-surface investigation is recommended prior to extraction in the undeveloped parts of the deposit.

Resource Area 13 occupies 80 acres (32 ha), of which 45 acres (18 ha) are considered available for extraction. Based on an average thickness estimate of 6 feet (2 m), sand and gravel resources total approximately 0.7 million tons (0.6 million tonnes). The resource area is readily accessible via King's Highway 69.

Selected Sand and Gravel Resource Area 14

Selected Sand and Gravel Resource Area 14 consists of two subaqueous fan deposits designated as Areas 14a and 14b. Sand is the predominant material exposed on the surface of these flat-lying features located in eastern Shawanaga geographic township. The deposits contain considerable potential resources of sand.

Pit no. 105 has been established in Area 14a. The faces in this pit reveal 8 to 12 feet (2 to 4 m) of fine to medium sand. Sand was also observed in 63 test holes excavated by MTO north of the pit. The test holes were excavated to a maximum depth of 18 feet (5 m) and exposed predominantly fine to coarse sand with only limited amounts of gravel. Bedrock was encountered in 23 of the test holes at an average depth of 10 feet (3 m). In 26 of the test holes, the water table occurred at an average depth of 13 feet (4 m). Approximately 50 percent of the samples taken from the test holes contained material suitable for use as GBC C. Much of this aggregate is very clean and fines may have to be added to act as a binder to ensure proper compaction. The remaining samples contained finer aggregate suitable for use as fill. The sand in Area 14a generally grades too fine for use in hot laid asphalt and blending would be required.

Similar quality aggregate was uncovered in Area 14b. Test holes PS-TH-17 to PS-TH-21 were excavated in this area to depths between 8.0 and 9.8 feet (2.4 and 3.0 m). They exposed predominantly very clean, medium sand. Finer sand was observed in test hole PS-TH-21 and a sample of this material contained 10 percent fines (Figure 16a). The sand in test holes PS-TH-17 and PS-TH-19 contained minor amounts of fine gravel (Figure 15a). Bedrock was encountered at the base of test hole PS-TH-19 and possibly at the base of PS-TH-21.

Resource Area 14 occupies approximately 190 acres (77 ha), of which 175 acres (71 ha) are considered available for extraction. Assuming average deposit thicknesses of 15 and 10 feet (5 and 3 m) for Areas 14a and 14b, respectively, potential resources total 6.1 million tons (5.5 million tonnes). A bush road branching off King's Highway 69 provides access to Area 14a. Area 14b is currently inaccessible by road.

Selected Sand and Gravel Resource Area 15

Two deposits are selected at the primary level of significance in Carling geographic township. These deposits have been traditional sources of aggregate in the township thus reducing the amount of aggregate presently available. The remaining resources are, however, significant locally because Carling Township has only extremely limited aggregate reserves. During field investigation aggregate was actively being extracted from the deposits for pit-run uses.

The northernmost deposit has been designated as Area 15a. Two pits are located in this ice-contact feature, in which medium sand is the dominant material exposed in the 3- to 5-foot (1 to 1.5 m) faces. Analysis of a sample of the sand from pit no. 133 indicates that it may be suitable for GBC C (Figure 12a). Minor amounts of fine gravel, till and clay were observed in sections of pit no. 133.

Area 15b is a subaqueous fan feature situated in the central part of the township. Three pits have been excavated in this area. The aggregate revealed in the 5- to 12-foot (1.5 to 4 m) faces of pit no. 123 consists predominantly of fine to medium sand. Isolated seams of gravelly coarse sand as well as pockets of silty fine sand also exist within the pit. The silty fine sand units should be avoided for uses requiring higher specifications. Sand is also revealed in the 4- to 10-foot (1 to 3 m) faces of pit nos. 122 and 124. Pit no. 124 is currently depleted of most material.

The depth of extraction in Resource Area 15 may be limited in places by the existence of a variable bedrock surface and a high water table. Water was observed on the floors of pit nos. 122 to 124 and 133, and the water table likely lies 4 feet (1.2 m) below the surface in seismic line PS-GT-21. In pit no. 123, aggregate has been extracted from below the water table. Bedrock is exposed on the floors of most of the pits.

Resource Area 15 totals 150 acres (61 ha). Cultural constraints and previous extraction reduce the area considered available to 75 acres (30 ha). Assuming an average deposit thickness of 5 feet (1.5 m) for Area 15a and 8 feet (2 m) for Area 15b, aggregate resources are estimated to be 1.2 million tons (1.1 million tonnes). Both deposits are readily accessible.

Selected Sand and Gravel Resource Area 16

Selected Sand and Gravel Resource Area 16 consists of five subaqueous fan deposits located in eastern Ferguson geographic township (Map 2B) and northern McDougall geographic township (Map 2C). Eleven pits have been developed in the resource area. Faces in the pits range from 4 to 40 feet (1 to 12 m) high and expose predominantly very fine to medium sand. The presence of fines within the sandy aggregate is the major factor influencing aggregate quality in the deposits. In certain areas, silt seams are commonly interbedded with the sands. Also, between 1 and 6 feet (0.3 and 2 m) of clay was observed overlying the aggregate in places within pit nos. 140, 141, 143, and 147. Because of the variable fines content, MTO reports that selective extraction measures are required for production of GBC C. Clay layers, where present at the surface, should be removed to avoid contamination of the underlying aggregate. The aggregate sampled from pit no. 155 (Map 2C) is considered acceptable for use as fill but borderline for production of GBC C (Figure 17a). During field investigation, aggregate was actively being extracted from pit no. 149 for septic bed and fill applications.

Minor amounts of gravel may also be available locally from the deposit. An isolated pocket of coarse gravel occurs in the northwestern faces of pit no. 143. This 15-foot (5 m) thick gravel unit was sampled and contained 61 percent gravel, 38 percent sand and 1 percent fines (Figure 12a). The gravel is considered well suited for crushing. Six feet (2 m) of clay and 5 feet (1.5 m) of silty fine sand overlies the gravel.

In Map Area 2B, Resource Area 16 occupies an estimated 238 acres (96 ha), of which 130 acres (53 ha) are considered potentially available for extraction. Assuming average deposit thicknesses ranging from 8 to 15 feet (2 to 5 m), resources total approximately 3.6 million tons (3.3 million tonnes).

RESOURCE AREAS OF SECONDARY SIGNIFICANCE (MAP 2B)

Harrison geographic township contains only extremely limited aggregate resources. The existing deposits occur as small patches of sand and gravel situated within bedrock depressions, or flanking rock knobs. Four of these deposits contain resources which are considered locally significant and have been selected at the secondary level of significance. The features in which pit nos. 85 and 87 have been established are of subaqueous fan origin. Faces in the pits consist of between 10 and 15 feet (3 and 5 m) of sand with minor amounts of fine gravel. Gravel contents of samples taken from the pits were 7 and 13 percent (Figure 10a). The aggregate is considered acceptable for uses including granular sub-base and fill. Coarser aggregate may be available from the ice-contact deposit in which pit no. 91 has been developed. Ten to fifteen feet (3 to 5 m) of sandy gravel is revealed in the pit. This material was sampled and contained 43 percent gravel, 55 percent sand and 2 percent fines (Figure 11a). It is considered well suited for pit-run uses. Aggregate extracted from the deposit containing pit no. 81 has been used for local forest access road development. Fine sand is the predominant material exposed in the 5- to 15-foot (1.5 to 5 m) faces of the pit.

Four deposits, classified as secondary resources in Shawanaga geographic township, are considered potential sources of at least GBC C and fill. Subsurface information for these features is provided by three pits, a test hole and a seismic line. Faces in pit nos. 99, 106 and 107 range from 6 to 12 feet (2 to 4 m) high and consist primarily of fine to medium sand. Slightly more than 5 feet (1.5 m) of similar sand overlies till and bedrock in test hole PS-TH-22. Samples taken from pit no. 106 and the test hole met specifications for GBC C (Figures 11a and 16a). During field investigation sand was actively being extracted from pit no. 99 for use as fill. Seismic line PS-GT-16 was conducted northwest of this pit and indicated the presence of the water table 4 feet (1.2 m) below the surface.

Deposits selected at the secondary level in Carling geographic township include four glaciolacustrine deposits and an ice-contact feature. These deposits are predominantly sources of sand suitable for low grade aggregate uses. A sample of glaciolacustrine sand from pit no. 118 was acceptable for use as GBC C (Figure 12a). The ice-contact material exposed in the 15-foot (5 m) faces of pit no. 132 consists of fine sand with occasional till pockets. Fill is probably the most readily produced aggregate product from the pit.

Three deposits in Ferguson geographic township have been selected at the secondary level of significance. Pit no. 138 has been developed in an ice-contact deposit. The 10-foot (3 m) faces in this pit reveal fine to medium sand with 1- to 3-foot (0.3 to 1 m) thick gravel layers. This material is likely suitable for use as granular sub-base. Limited quantities of sand suitable for local uses may be available from the subaqueous fan deposit containing pit nos. 144, 145 and 146. The 8- to 15-foot (2 to 5 m) faces expose predominantly fine to medium sand with minor amounts of gravel. Several of the faces contain 2- to 4-foot (0.6 to 1 m) thick silt and clay layers, and this fine material may occur elsewhere in the deposit. Sand may also be available from the glaciolacustrine deposit situated along the southern boundary of the township.

C. PARRY SOUND MAP AREA

SELECTED SAND AND GRAVEL RESOURCE AREAS (MAP 2C)

Selected Sand and Gravel Resource Area 16

Resource Area 16c straddles the boundary of Ferguson and McDougall geographic townships. Most of Selected Resource Area 16 is located in Ferguson geographic township in Map Area B, and it has therefore been discussed in the Pointe au Baril Station Map Area descriptions which precede this section. For detailed information on Resource Area 16c refer to the previous section.

The portion of Selected Resource Area 16c which is located in McDougall geographic township occupies 125 acres (51 ha), of which 65 acres (26 ha) are considered available for extraction. Based on a deposit depth of 12 feet (4 m), resources total an estimated 2 million tons (1.8 million tonnes).

Selected Sand and Gravel Resource Area 17

Selected Sand and Gravel Resource Area 17 consists of a subaqueous fan deposit located in central McDougall geographic township. Two pits have been excavated into the northern and southern slopes of this mound-shaped feature. The pits have faces between 6 and 20 feet (2 and 6 m) high which expose predominantly fine to medium sand with minor amounts of gravel. MTO records for pit no. 185 indicate that the aggregate is suitable for GBC C and fill. Selective extraction measures would be required to avoid sections containing abundant silt in the production of GBC C. Pit no. 185 was approaching depletion, whereas material was actively being extracted from pit no. 186 during field investigation. The sand extracted was being used for septic bed construction.

This relatively thick sand deposit occupies 15 acres (6 ha), of which 11 acres (4 ha) are considered available for extraction. Assuming an average deposit thickness of 20 feet (6 m), sand resources are estimated to be 0.6 million tons (0.5 million tonnes).

Selected Sand and Gravel Resource Area 18

Three subaqueous fan deposits are included in Selected Sand and Gravel Resource Area 18 in southern McDougall geographic township. These relatively thick features have been deposited within a northeast to southwest trending bedrock controlled valley. The resource area represents an important source of crushed stone which lies in close proximity to local markets in Parry Sound.

Four pits are located in the resource area. Faces in these pits range from 7 to 35 feet (2 to 11 m) high. They generally reveal up to 30 feet (9 m) of silty fine to medium sand overlying medium to coarse sand with pockets and seams of crushable gravel. The exception is pit no. 198 in which gravel layers occur throughout the faces. A sample taken from this pit consisted of 39 percent gravel, 58 percent sand and 3 percent fines (Figure 18a). Aggregate has been extracted from the resource area for uses including Hot Laid (HL) No. 4 stone, 16 mm crushed stone, granular base course and winter sand. Selective extraction and sand control is required in sections for crushing. MTO data indicate that in certain layers the coarse aggregate may contain a high percentage of poor quality gravel which can limit high specification uses. Blending would be required for asphaltic sand uses. Aggregate from pit no. 198 was being crushed at the time of field investigation.

In the undeveloped area surrounding pit no. 198, the three seismic lines run indicated that aggregate may extend to a considerable depth. The water table is suspected to be at a depth of 8 feet (2.4 m) beneath seismic line PS-GT-26. Clay was observed at the surface of the area north of pit no. 201. However, this clay may overlie and mask coarser aggregate. This relationship was observed in one face of pit no. 201 where 2 feet (0.6 m) of clay overlies sand.

Resource Area 18 is readily accessible and is well situated with regards to local markets. It occupies approximately 190 acres (77 ha). Cultural constraints and previous extraction reduce the area currently available to 125 acres (51 ha). Assuming average deposit thickness values ranging from 12 to 25 feet (4 to 8 m), sand and gravel resources total 6.2 million tons (5.6 million tonnes).

Selected Sand and Gravel Resource Area 19

A subaqueous fan deposit located in north-central Foley geographic township has been selected at the primary level of significance. Subsurface information for the deposit is provided by two pits and a roadside exposure. The 10- to 15-foot (3 to 5 m) faces in pit no. 211 expose 6 feet (2 m) of fine to medium sand overlying silty fine sand. MTO data for pit no. 212 reveal that sand was once selectively extracted from the pit for use as GBC C. This pit has been rehabilitated. The roadside exposure reveals 20 feet (6 m) of medium to coarse sand.

Resource Area 19 occupies 42 acres (17 ha), of which 30 acres (12 ha) are considered available for extraction. Based on an average thickness estimate of 15 feet (5 m), aggregate resources are approximately 1.1 million tons (1.0 million tonnes). The resource area is readily accessible from Secondary Highway 518.

Selected Sand and Gravel Resource Area 20

Selected Sand and Gravel Resource Area 20 is located in southwestern Foley geographic township. Subsurface information for this subaqueous fan deposit is supplied by three pits and two seismic lines. The 4- to 10-foot (1 to 3 m) faces of pit nos. 228 and 230 reveal predominantly silty fine to medium sand with very minor amounts of gravel. During field investigation this material was being extracted from pit no. 230 for septic bed and fill applications. Coarser aggregate occurs in the 10-foot (3 m) faces of pit no. 229. A 6-foot (2 m) thick pocket of fine gravel is interbedded with sandy aggregate in the pit. With selective extraction, this gravel unit may be a potential source of GBC B. A considerable depth of aggregate is indicated by the two seismic lines (PS-GT-30, PS-GT-31). The water table is, however, suspected to be within 10 feet (3 m) of the surface beneath line PS-GT-31.

Resource Area 20 occupies 125 acres (51 ha), of which 70 acres (28 ha) are currently available for extraction. Assuming an average deposit depth of 15 feet (5 m), the available aggregate resources are estimated to be 2.6 million tons (2.4 million tonnes). The area is accessible via a cottage access road.

Selected Sand and Gravel Resource Area 21

A subaqueous fan deposit located in south-central Foley geographic township is Selected Sand and Gravel Resource Area 21. Sand is the predominant material exposed at the surface of this deposit. Although the deposit has been classified as a sand source, gravel is also locally abundant. Fine gravel is exposed in the 20-foot (6 m) faces of pit no. 233. A sample of this material contained 64 percent gravel, 35 percent sand and 1 percent fines (Figure 19a). Similar gravel is found in the western faces of pit no. 234. Eight feet (2 m) of sandy gravel overlies 17 feet (5 m) of slumped material in these faces. Other faces in the pit consist of 10 feet (3 m) of silty fine to medium sand. A 3-foot (1 m) thick clay layer is interbedded with this sand. The sand in the deposit appears suitable for use as GBC C and fill, whereas GBC B may be produced with selective extraction of the gravel units. Detailed subsurface investigation in the undeveloped parts of the deposit is recommended to determine if additional gravel exists at depth.

Resource Area 21 occupies approximately 33 acres (13 ha), of which 20 acres (8 ha) are presently considered available for extraction. Assuming an average deposit thickness of 12 feet (4 m), resources are estimated to be 0.6 million tons (0.5 million tonnes). Access to the area is provided by a gravel-surfaced township road.

Selected Sand and Gravel Resource Area 22

Four subaqueous fan deposits located near Orrville in Christie geographic township constitute Selected Sand and Gravel Resource Area 22. In general, the deposits are sand sources suitable for GBC C and fill. In certain areas, however, the deposits contain higher quality aggregate potentially suitable for uses including GBC B and winter sand. The features have been designated as Areas 22a to 22d on Map 2C.

Area 22a is the northernmost deposit. Two pits have been opened in this area. Faces in pit no. 252 range in height from 10 to 15 feet (3 to 5 m). Five feet (1.5 m) of variably bedded silty fine to medium sand overlies clean fine to coarse sand in the pit. The sand is likely suitable for use as GBC C and fill. Three feet (1 m) of till overlies 4 feet (1 m) of sandy gravel in pit no. 253. This gravel may be suitable for higher specification aggregate uses if the upper till unit is removed prior to extraction. Further subsurface investigation in Area 22a may uncover additional quantities of gravel, especially in the vicinity of pit no. 253.

Three pits are located in Area 22b. The pits consist of 5 to 10 feet (1.5 to 3 m) of medium to coarse sand with less than 5 percent fine gravel. Possible uses of this material include granular sub-base, winter sand and fill. Similar material may be available in the undeveloped part of the deposit south of the pits. Bedrock was observed in the floor of two of the pits.

During field investigation, sandy aggregate was actively being extracted from pit no. 271 in Area 22c. The sand was being extracted for uses including septic beds, road construction, and fill. Although sand is the predominant material revealed in the 5- to 15-foot (1.5 to 5 m) faces of the pit, gravel is exposed between two bedrock ridges in the northern part of the pit. This gravel, however, is nearing depletion. Faces in pit no. 272 consist of 5 to 7 feet (1.5 to 2 m) of material ranging from medium sand to coarse gravel. This aggregate appears best suited for pit-run uses as gravel in the crushable size range is lacking.

Subsurface data for Area 22d is provided by the 10- to 30-foot (3 to 9 m) faces in pit no. 270. The faces consist mainly of fine to coarse sand suitable for uses including GBC C and fill. A sample of this material contained 99 percent sand and 1 percent fines (Pit 270a, Figure 20a). In one section of the pit, however, the sand overlies 10 to 12 feet (3 to 4 m) of variably bedded sand and fine gravel. A sample taken from this coarser unit consisted of 25 percent gravel, 72 percent sand and 3 percent fines (Pit 270b, Figure 20a). It appears well suited for use as GBC B. Additional resources of gravelly sand may occur in the undeveloped parts of the deposit.

Resource Area 22 occupies approximately 212 acres (86 ha), of which 160 acres (65 ha) are potentially available for extraction. Assuming average deposit depths ranging from 9 to 25 feet (3 to 8 m), aggregate resources are estimated to total 5.5 million tons (5.0 million tonnes). The resource area is readily accessible.

Selected Sand and Gravel Resource Area 23

Three ice-contact features have been selected at the primary level of significance in Christie geographic township. The ice-contact ridge situated east of Maple Lake has been designated as Area 23a. Pit no. 273 has been excavated into this ridge. In the eastern faces of this pit, 10 feet (3 m) of medium to coarse gravel overlies 10 feet (3 m) of slumped sand and gravel. A sample taken from this face consisted of 49 percent gravel which appears suitable for crushing (Pit 273a, Figure 20a). Ten feet (3 m) of medium sand, exposed in the southern faces of the pit, contains 99 percent sand and 1 percent fines (Pit 273b, Figure 20a). A variety of aggregate products may be produced from this deposit with selective extraction measures.

The remaining two ice-contact features, designated as Areas 23b and 23c, are located between Flaxman and Horseshoe lakes. Pit no. 277 was being developed in Area 23b during field investigation and consisted of two separate excavations. In one excavation, 6 feet (2 m) of medium sand was exposed and in the other, faces revealed 8 feet (2 m) of sand with 25 to 30 percent fine to medium gravel. Pit nos. 278 and 279 are located in Area 23c. Five feet (1.5 m) of silty fine to medium sand overlies 4 feet (1 m) of coarse, crushable gravel in pit no. 278. Additional quantities of gravel may be available northeast of the pit. The aggregate in pit no. 279 has been extracted to bedrock and depleted.

Resource Area 23 is readily accessible via cottage access roads. It occupies approximately 50 acres (20 ha), of which 44 acres (18 ha) are considered available for extraction. Based on average thickness estimates ranging from 8 to 15 feet (2 to 5 m), aggregate resources total 1.3 million tons (1.2 million tonnes).

Selected Sand and Gravel Resource Area 24

Selected Sand and Gravel Resource Area 24 consists of three subaqueous fan deposits, designated as Areas 24a to 24c, situated along the boundary between Christie and Humphrey geographic townships. Pit no. 286 is situated in the northeastern corner of Area 24a. The dominant material exposed in the 8- to 12-foot (2 to 4 m) faces of the pit is fine to medium sand. Isolated pockets of gravelly coarse sand are occasionally present near the base of the pit faces. The aggregate extracted from the pit has been used for granular sub-base applications. Sand is also exposed in pit nos. 293 and 349 which have been identified in the southern part of the area. Faces in these pits range in height from 5 to 15 feet (1.5 to 5 m). The sand was sampled from pit no. 293 and consisted of 98 percent sand and 2 percent fines (Figure 21a). Clay layers between 2 and 4 feet (0.6 and 1.2 m) thick were observed overlying the sand in some faces of pit nos. 286 and 293. These layers should be removed prior to extraction of the underlying aggregate. Bedrock occurs on the floors of pit nos. 286 and 349.

The aggregate resources in Areas 24b and 24c are considered to be of similar quality as those in Area 24a, but the deposits are significantly thicker. Fifty feet (15 m) of fine to coarse sand is revealed in the faces of pit no. 287 which have been excavated in Area 24b. A sample of this sand contained 2 percent gravel, 90 percent sand and 8 percent fines (Figure 20a). The ridge which marks the southern boundary of Area 24c rises up to 20 feet (6 m) above the surface of Area 24a.

Resource Area 24 occupies 315 acres (127 ha). A significant part of the area remains undeveloped and approximately 270 acres (109 ha) are potentially available for extraction. Assuming average deposit thickness ranging from 12 to 30 feet (4 to 9 m), resources of sandy aggregate are estimated to be 9.0 million tons (8.2 million tonnes).

Selected Sand and Gravel Resource Area 25

Three deposits located near Crane Lake in Conger geographic township constitute Selected Sand and Gravel Resource Area 25. The westernmost feature has been designated as Area 25a. Pit no. 298 has been opened in this ice-contact deposit. Two feet (0.6 m) of clay overlies between 18 and 23 feet (6 and 7 m) of sandy fine to medium gravel in the pit. The gravel was sampled and contained 41 percent gravel, 58 percent sand and 1 percent fines (Figure 21a). This material is considered best suited for pit-run uses as gravel in the crushable size range is lacking.

Faces in pits excavated in the subaqueous fan that has been designated Resource Area 25b reveal 5 to 15 feet (1.5 to 5 m) of mainly sand. This sand appears suitable for uses including GBC C and fill. In sections within pit nos. 314 and 315 pockets of gravel occur within the sandy sediment. Limited amounts of higher specification aggregates may be produced with selective extraction of these pockets. Up to 3 feet (1 m) of clay overlies the aggregate in places within pit nos. 313 and 315.

Area 25c is the easternmost deposit in the resource area. Four pits have been identified in this subaqueous fan feature. Faces in pit no. 321 range from 10 to 15 feet (3 to 5 m) high and consist largely of medium sand. This material was sampled and contained 97 percent sand and 3 percent fines (Pit 321a, Figure 22a). The sand overlies a 5-foot (1.5 m) thick layer of fine gravel. A sample from this layer consisted of 55 percent gravel, 44 percent sand and 1 percent fines (Pit no. 321b, Figure 22a). Similar materials were observed in pit nos. 320 and 322. In these pits, 5 to 8 feet (1.5 to 2 m) of fine to medium sand overlies 4 to 5 feet (1.2 to 1.5 m) of fine to medium gravel. Variable amounts of very silty fine sand may occur in the upper sand unit. Six to fifteen feet (2 to 5 m) of predominantly medium sand is exposed in pit no. 323. Bedrock was observed in the floor and/or faces of pit nos. 320 to 322. The deposit appears well suited for the production of a variety of aggregate products.

Resource Area 25 totals 71 acres (29 ha), of which 50 acres (20 ha) are considered currently available for extraction. Assuming average deposit thicknesses of 20 feet (6 m) for Area 25a and 8 feet (2 m) for Areas 25b and 25c, sand and gravel resources are approximately 1.3 million tons (1.2 million tonnes). Cottage and forest access roads provide access to the resource area.

Selected Sand and Gravel Resource Area 26

Selected Sand and Gravel Resource Area 26 is a subaqueous fan deposit located between Conger and Crane Lakes in Conger geographic township. The deposit has been formed along the northern edge of a northeast to southwest trending bedrock controlled valley. Slopes with local relief in excess of 15 feet (5 m) mark the southern boundary of the deposit. Sand is the predominant material exposed at the surface of the deposit. Subsurface data are provided by pit no. 303, seismic line PS-GT-38 and test holes excavated by MTO.

Faces in pit no. 303 are 15 feet (5 m) high and expose a variety of materials. The western and northern faces consist largely of fine to coarse sand. A sample taken from these faces contained 97 percent sand and 3 percent fines (Pit no. 303a, Figure 22a). A clay seam up to 3 feet (1 m) thick was observed in the western faces. Six feet (2 m) of fine to medium sand overlies 9 feet (3 m) of sandy fine to medium gravel in the eastern faces. This gravel unit was sampled and contained 49 percent gravel, 48 percent sand and 3 percent fines (Pit no. 303b, Figure 22a). Several test holes were excavated by MTO to a maximum depth of 15 feet (5 m) in the vicinity of the pit. Gravel was encountered in the majority of these test holes beneath 2 to 10 feet (0.6 to 3 m) of sand. This coarse aggregate generally contained between 55 and 75 percent gravel. Results of seismic line PS-GT-38 indicate approximately 27 feet (8.2 m) of aggregate overlies bedrock.

In general, the material in Resource Area 26 is considered well suited for the extraction of pit-run aggregates and is a potential source of crushed gravel. Selective extraction and sand control measures would probably be required for crushing. The aggregate also contains an abundance of mica particles which do not bond well with asphalt and cement mixes. Nevertheless, Area 26 is considered to contain the largest quantities of coarse aggregate remaining in the township.

Resource Area 26 occupies 70 acres (28 ha), of which 50 acres (20 ha) are potentially available for extraction. Assuming an average thickness of 15 feet (5 m) for the deposit, resources are estimated to be 1.9 million tons (1.7 million tonnes). Access to the area is provided by a cottage access road.

Selected Sand and Gravel Resource Area 27

Three subaqueous fan deposits located near the boundary between Conger and Humphrey geographic townships make up Selected Sand and Gravel Resource Area 27. They are relatively flat features which have been deposited within generally north to south trending bedrock depressions. The deposits are considered to have been laid down by the same meltwater system that deposited Resource Area 24. Consequently, both resource areas contain similar quality aggregate. Resource Area 27 contains large potential aggregate resources and has been a traditional source of aggregate in the area.

The southernmost feature has been designated as Area 27a. Aggregate has been extracted from five pits in the area. Pit nos. 327, 328 and 330 expose 5 to 15 feet (1.5 to 5 m) of predominantly silty fine to medium sand. The 8- to 20-foot (2 to 6 m) high faces in pit nos. 329 and 331 consist largely of medium to coarse sand. Seams of sandy gravel and fine sand also occur within pit no. 331. Variable amounts of clay and/or silt were observed in all pits. MTO has excavated several test holes in the area between pit nos. 328 and 331. Most test holes were excavated to depths between 10 and 15 feet (3 and 5 m) and expose mainly fine sand. Silt and clay seams were common in many of the test holes. Bedrock was encountered at depths between 1 and 14 feet (0.3 and 4 m) in some areas.

Pit no. 335 has been established in Area 27b. Faces in this pit range from 10 to 25 feet (3 to 8 m) high and consist largely of fine sand with minor amounts of medium sand. Very silty fine sand units are common within the pit, especially in the upper 8 feet (2 m) of the faces. A sample taken from one of these units contained 43 percent sand and 57 percent fines (Pit 335a, Figure 23a). Several sections within the pit also consist of clean, fine to medium sand. One of these sections was sampled and consisted of 98 percent sand and 2 percent fines (Pit 335b, Figure 23a). Similar quality aggregate was observed in pit nos. 332, 333, 334 and 336 which have also been opened in Area 27b.

The northernmost deposit, designated as Area 27c, contains four pits. Faces in pit nos. 340 and 341 consist primarily of 5 to 15 feet (1.5 to 5 m) of fine to coarse sand which can vary from being very clean to silty. In places, 2- to 6-foot (0.6 to 1.8 m) thick gravelly coarse sand pockets were observed in pit no. 341. A sample of this material consisted of 21 percent gravel, 78 percent sand and 1 percent fines (Pit 341a, Figure 23a). A face consisting of silty fine sand was also sampled in pit no. 341. The sample contained 79 percent sand and 21 percent fines (Pit no. 341b, Figure 23a). Four to eight feet (1 to 2 m) of predominantly fine to medium sand is exposed in pit nos. 342 and 343. MTO has excavated a number of test holes to depths of 15 feet (5 m) in the vicinity of these two pits. The test holes contained sands which varied from being too fine to being acceptable for use as granular sub-base. The existence of clay and silt layers within the sands was the major factor restricting suitability.

In general, the aggregate in Resource Area 27 is considered best suited for production of GBC C and fill. Selection would be required for production of GBC C as variable amounts of clay, silt and very fine sand are present. Further subsurface investigation should be conducted, however, to determine if additional quantities of gravel and gravelly sand, similar to that exposed in pit nos. 331 and 341, underlie other parts of the resource area. GBC B may be produced with selective extraction of these coarser units. MTO reports that pit no. 335 may also be a potential source of blending sand.

Resource Area 27 totals approximately 750 acres (305 ha). Cultural constraints and previous extraction reduce the area potentially available for extraction to 335 acres (136 ha). Major cultural constraints include Georgian Bay Airport in Area 27b and residential development in Area 27c. Assuming average deposit thicknesses of 12 feet (4 m) for Areas 27a and 27c and 20 feet (6 m) for Area 27b, resources are estimated to be 10.7 million tons (9.7 million tonnes). The resource area is readily accessible.

Selected Sand and Gravel Resource Area 28

Two deposits in northeastern Humphrey geographic township have been selected at the primary level of significance. The ice-contact feature (Area 28a) flanks the south side of a bedrock ridge. The 10- to 12-foot (3 to 4 m) high faces of pit no. 362 have been excavated in this feature. Material ranging from fine sand to sandy gravel is exposed in the faces. The gravel generally underlies the sands and is exposed in excavations beneath the pit floor. In one face, 4 to 6 feet (1 to 2 m) of fine to medium sand overlies 6 to 8 feet (2 m) of sandy gravel and gravelly sand. This lower unit was sampled and contained 32 percent gravel and 68 percent sand (Figure 24a). Gravel was being selectively extracted for crushing in the pit during field investigation. The water table lies just below the pit floor.

The subaqueous fan deposit has been designated as Area 28b. Aggregate has been extracted from two pits in the deposit. Pit no. 368 reveals 8 to 10 feet (2 to 3 m) of fine to medium sand, but is nearing depletion. The 10- to 20-foot (3 to 6 m) high faces of pit no. 369 reveal aggregate of variable quality. Sand is the predominant material exposed in the faces, although gravel layers up to 5 feet (1.5 m) thick are present locally. Clay layers between 2 and 4 feet (0.6 and 1.2 m) thick overlie the aggregate in sections. Silt seams and bodies of silty very fine sand also occur. Generally, the aggregate available from the pit appears suitable for pit-run uses. Selective extraction measures may be required for production of granular sub-base, however, to avoid sections containing excessively fine material. The undeveloped western part of the deposit is expected to contain similar quality aggregate as that exposed in pit no. 369. Aggregate resources in the eastern part of the feature are near depletion.

Areas 28a and 28b total 150 acres (61 ha), of which 75 acres (30 ha) are considered presently available for extraction. Assuming average deposit thicknesses of 10 and 12 feet (3 and 4 m) for Areas 28a and 28b, respectively, aggregate resources are estimated to be 2.1 million tons (1.9 million tonnes). The deposits are readily accessible via the existing road network.

RESOURCE AREAS OF SECONDARY SIGNIFICANCE (MAP 2C)

A number of deposits have been selected at the secondary level in McDougall geographic township. They include six glaciolacustrine plain deposits. Pits developed in these deposits are primarily sand sources suitable for GBC C and fill. The deposits may be capped by a discontinuous layer of clay and contain variable quantities of silt. Consequently, selective extraction may be required in places to produce GBC C. Subsurface information is lacking for the glaciolacustrine deposit located west of Resource Area 18a. Sand is, however, exposed at the surface of the deposit and may continue at depth. The ice-contact feature in which pit no. 165 has been opened is a potential source of GBC B. A sample taken from the pit contained 12 percent gravel, 85 percent sand and 3 percent fines (Figure 17a). Another ice-contact deposit is located west of the pit. Sand is exposed at the surface of 20-foot (6 m) high slopes which form the western boundary of the deposit. The subaqueous fan features in which pit nos. 188 and 189 are situated are also potential sand sources. The pits reveal between 3 and 40 feet (1 and 12 m) of silty fine to medium sand. A sample taken from pit no. 189 contained 76 percent sand and 24 percent fines which is likely suitable for use as fill (Figure 17a). Six feet (2 m) of silt and clay overlies the aggregate in pit no. 189. The subaqueous fan feature which adjoins Resource Area 18a may contain similar materials to those found in the resource area.

A subaqueous fan deposit is situated in the southeastern corner of Cowper geographic township. It is a relatively flat feature, although slopes in excess of 10 feet (3 m) high mark its southern boundary. Several shallow test pits were excavated in the deposit and revealed material ranging from medium sand to gravelly sand. The deposit is considered a good potential source of pit-run aggregate. The feature is currently not accessible by road.

Areas of secondary significance in Foley geographic township include six subaqueous fan deposits and two glaciolacustrine features. These deposits consist mainly of fine to medium sand suitable for low specification aggregate uses. In places, the deposits may contain variable amounts of silt and clay, and this excessively fine material should be avoided during extraction. Coarser aggregate is exposed at the base of pit no. 207. Silty fine sand overlies 8 feet (2 m) of aggregate varying from medium sand to medium gravel in one section of pit no. 207. The upper sand unit was sampled and consisted of 82 percent sand and 18 percent fines (Pit 207a, Figure 18a). A gravel pocket in the lower unit was also sampled and contained 65 percent gravel, 34 percent sand and 1 percent fines (Pit 207b, Figure 18a). The faces of pit no. 215 were slumped at the time of field investigation, however, 6 to 8 feet (2 m) of gravel underlying 17 to 19 feet (5 to 6 m) of sand was previously observed by MTO. This lower gravel unit has been used for crushing, but quantities of crushable material are presently limited. Pockets of sandy gravel also occur within a 5- to 10-foot (1.5 to 3 m) deep excavation in the subaqueous fan deposit located along the border between Cowper geographic township and Foley geographic township.

The subaqueous fan deposit along the north shore of Otter Lake may represent a potentially valuable source of blending sand in close proximity to quarry no. 15, however residential development may inhibit the availability of the aggregate.

Two ice-contact deposits have also been selected at the secondary level in Foley geographic township. Pit no. 239 has been identified in one of these features. The 6- to 20-foot (2 to 6 m) high faces in this pit consist largely of medium to coarse sand suitable for pit-run uses. Subsurface information for the ice-contact feature located south of McNutt Lake is lacking. A shallow test pit was excavated in the western part of the deposit and uncovered 3 feet (1 m) of gravelly sand. Similar material may occur elsewhere in the deposit.

Christie geographic township contains sixteen deposits of secondary significance. The deposits are primarily sand sources suitable for uses including GBC C and fill, but isolated pockets of gravel and gravelly sand were seen in pits (nos. 254, 257, 280 and 285) developed in the deposits. Higher grade aggregate products such as GBC B may be produced with selective extraction of these pockets. In the deposits in which pit nos. 246 to 249, 267 to 269, and 283 to 285 have been established, the aggregate may be overlain in places by a thin layer of clay. These clay layers should be removed prior to extraction of the underlying aggregate. Only limited amounts of aggregate may be available from the deposits in which pit nos. 254 to 258, 263, 264, 280, 282 and 294 have been opened, because of cultural constraints and/or extensive previous extraction. The remaining resources in these features may, however, be important locally.

Secondary resources in Conger geographic township are similar in quality to those described for Christie geographic township. The six deposits consist predominantly of fine to medium sand which is suitable for low specification aggregate uses. During field investigation, aggregate was actively being extracted from pit no. 299 in one of these deposits. Sand was extracted from below the water table in the floor of this pit for uses including fill, road subbase and septic beds. With the exception of the features located along McQuillan and Spider Lakes, clay layers up to 2 feet (0.6 m) in thickness were observed in these deposits. Extensive extraction has occurred in the deposits in which pit nos. 311, 317 and 318 are located. The remaining material in these features may, however, meet some low specification aggregate demands. No extraction has occurred in the sand deposit situated along Spider Lake. Terraces in excess of 10 feet (3 m) high mark the southern slopes of the feature and indicate a potentially thick deposit.

The remaining deposits classified at the secondary level are situated within Humphrey geographic township. They include eight sand deposits which are potentially suitable for use as GBC C and fill. Although the deposits in which pit nos. 351, 352, 367, 371, 375, 376, 378 and 379 are located contain limited aggregate resources, the remaining resources are considered locally significant. Relatively greater amounts of aggregate may be available from the other secondary features. The average thickness of potentially available aggregate within these deposits has been estimated to range from 6 to 8 feet (2 m). Factors such as the existence of a variable bedrock surface, a high water table and/or excessively fine aggregate may inhibit extraction in parts of these deposits.

RESOURCE AREAS OF TERTIARY SIGNIFICANCE (MAPS 2A TO 2C)

Most deposits selected at the tertiary level of significance have very limited aggregate potential. For several of the tertiary deposits, however, the aggregate potential is unknown. Little subsurface data is available for these features, and deposit boundaries are based primarily on aerial photograph interpretation. In a number of these features the geological setting is similar to that observed in deposits considered to be good aggregate resources elsewhere in the report area. Therefore, detailed subsurface investigation may increase the importance of these resources. Deposits having these characteristics include the ice-contact deposit north of the Key River in the Key Harbour Area, the outwash feature in Mowat geographic township west of test hole PS-TH-5, the deposits in which pit nos. 57 and 61 have been opened in Wallbridge geographic township, ice-contact features along Smoky and Noganosh Lakes in Brown geographic township, an ice-contact deposit southwest of Mazur Lake in Carling geographic township, ice-contact features in the vicinity of Marsh Lake in Ferguson geographic township, and an ice-contact feature situated south of Spider Lake in Conger geographic township.

BEDROCK GEOLOGY AND RESOURCE POTENTIAL

The Precambrian bedrock in the area is part of the Grenville Province of the Canadian Shield. Highly deformed and recrystallized gneiss is the major rock type (Figure 3). Geological mapping and reports by Satterly (1943), Hewitt (1967), Wynne-Edwards (1972), Davidson *et al.* (1979, 1982, 1985), Lumbers (1978), Davidson and Morgan (1981), Culshaw *et al.* (1983), Culshaw *et al.* (1988), Villard *et al.* (1984), Van Berkel and Schwerdtner (1986), and Marmont and Johnston (1987) cover parts of the report area. Much of the northern part of the report area has not been mapped in detail.

In general, the bedrock geology of the area is extremely complex. Metamorphic and deformation processes are the main causes of this complexity (Marmont and Johnston 1987). The report area is underlain by rocks of the Central Gneiss Belt, which is a division of the Grenville Province (Wynne-Edwards 1972). The rocks within the belt can be subdivided into domains (Davidson and Morgan 1981). Much of the Parry Sound Map Area (Map 1C) is underlain by bedrock of the Parry Sound Domain. The exception is the southern part of the map area which is included within the Muskoka Domain. The Britt Domain encompasses the northern part of the project area.

Rocks of the Britt Domain consist primarily of paragneisses that have been intruded by younger plutonic rocks (Davidson and Morgan 1981). These plutonic rocks have subsequently been deformed and metamorphosed into orthogneiss. A more diverse variety of rock types are included within the Parry Sound Domain where bodies of mafic rock, marble and other metasedimentary rocks, and gabbroic anorthosite are relatively abundant. The Muskoka Domain consists largely of a variety of gneissic rocks.

Much of the Parry Sound to French River area is underlain by hard and durable bedrock which is well suited for a variety of aggregate applications. However, the rocks may exhibit wide variations locally with respect to their use as aggregate. Consequently, any site proposed for quarry development should be tested in detail prior to extraction. Highly weathered, brittle and friable rock which is unacceptable for aggregate use may occur within all rock types in the area. Marbles and pelitic gneisses are especially friable rocks. The smooth cleavage and fracture surfaces of some of the coarse-grained rocks with high mica, feldspar and quartz contents may hinder the adhesion of asphalt and cement mixes causing bonding problems. This particular problem may be circumvented by weathering of the rocks for a period of time in stockpiles or by adding chemicals (anti-stripping agents) which erode the smooth surfaces and allow better adhesion. Some rock varieties may also be very hard, and the crushing of this material may cause excessive wear on processing equipment. Although the bedrock in the area may meet MTO specifications for concrete aggregate, the local rock may not be accepted by MTO for use in Portland cement concrete which will be exposed to de-icing salts. There could be a potential bond problem between the aggregate and cement.

Fifteen quarries have been identified within the project area. Many are located near Parry Sound, or along King's Highway 69 and Secondary Highway 522. These quarries have been developed largely in response to the lack of crushable gravel in the area. Faces in the quarries range from 5 to 40 feet (1.5 to 12 m) high and expose predominantly migmatitic gneisses. The crushed stone from these quarries is generally acceptable for uses including GBC A, 16 mm crushed stone and asphaltic stone but, as discussed, may not be acceptable for Portland cement concrete aggregate which will be exposed to de-icing salts. Blending with natural sands is required if quarry screenings are to be used in asphaltic sand. MTO reports that the material in one quarry is unsuitable for hot-laid stone uses. Another quarry, located near Killbear Provincial Park, consists of possible meta-arkose and is a potential source of HL No. 1 aggregate. Application of anti-stripping agents to the rock from a number of the quarries is required if the rock is to be used for asphaltic stone. During field investigation, crushed stone was actively being extracted from three quarries within the area. The stone was being used largely for construction of passing lanes along King's Highway 69. One quarry has been developed at Mill Lake within the town of Parry Sound, primarily as a source of flagstone.

Within the report area, considerable latitude exists in choosing sites for potential bedrock extraction. There are extensive areas where bedrock is exposed at the surface or is covered by thin drift. MTO has investigated the aggregate quality of over 40 rock exposures in the area. Most of these exposures contain bedrock acceptable for GBC A and 16 mm crushed stone uses, and potentially suitable for asphaltic stone. Areas in which overburden thickness may restrict quarry development are generally confined to valleys such as the Little Seguin River valley.

AGGREGATE QUALITY AND SUITABILITY

During field investigation, 88 samples were taken from pit faces and test holes. All of these samples were analysed for grain size distribution (Figures 4a to 24b), and selected samples were subjected to four aggregate quality tests. These tests include the Los Angeles Abrasion and Impact Test, Absorption, and Magnesium Sulphate Soundness Test, as well as Petrographic Analysis. The results of these tests are

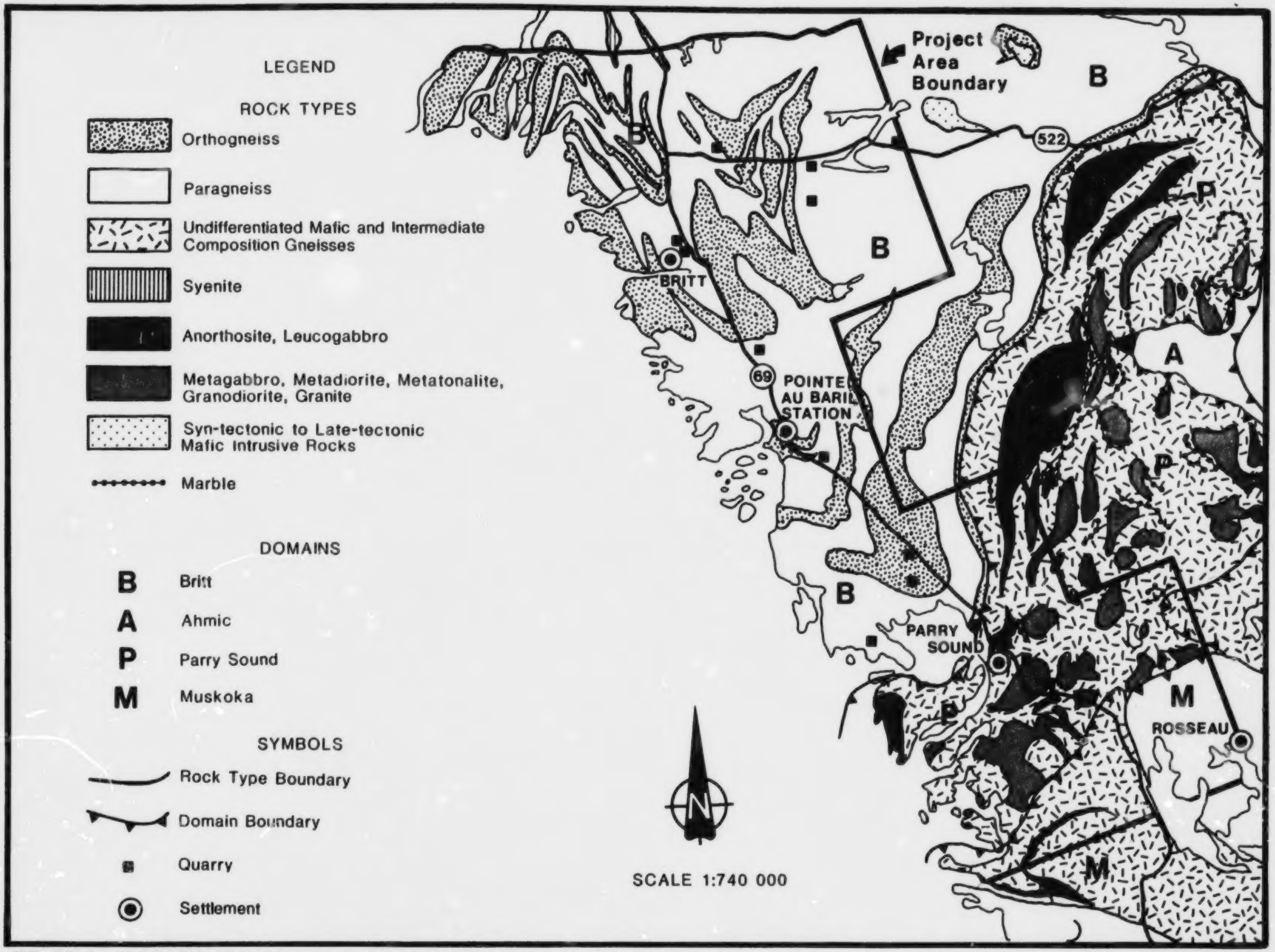

LEGEND
ROCK TYPES
Orthogneiss
Paragneiss
Undifferentiated Mafic and Intermediate Composition Gneisses
Syenite
Anorthosite, Leucogabbro
Metagabbro, Metadiorite, Metatonalite, Granodiorite, Granite
Syn-tectonic to Late-tectonic Mafic Intrusive Rocks
Marble
DOMAINS
B Britt
A Ahmic
P Parry Sound
M Muskoka
SYMBOLS
Rock Type Boundary
Domain Boundary
Quarry
Settlement
Project Area Boundary
B
A
P
M
522
69
BRITT
POINTE AU BARIL STATION
PARRY SOUND
ROSSEAU
N
SCALE 1:740 000

FIGURE 3: BEDROCK GEOLOGY OF THE PARRY SOUND TO FRENCH RIVER AREA. Modified after Davidson et al. (1982), and Marmont and Johnson (1987).

portrayed in Table 7. The four quality tests were performed in London by the Soils and Aggregates Section laboratories of the MTO. Grain size analyses were conducted in either the MTO laboratories or in the Geoscience Laboratories, Geoservices Section, Ontario Geological Survey.

The major limiting factor with respect to aggregate quality in the project area is the excessive fineness of the aggregate. In 31 of the samples analysed, the aggregate graded too fine for use as GBC C. Seventeen of these samples contained over 10 percent silt and clay. In many of the area's pits, selective extraction measures are recommended to avoid sections containing abundant clay, silt and/or very fine sand beds. The clay layers often overlie the sand and gravel, and these layers should be removed to avoid contamination of the underlying aggregate.

The gravel in the report area also tends to be fine. With the exception of a small number of sources, the gravel is too fine for crushing purposes. The coarse aggregate, however, is considered generally suitable for uses including GBC A, 16 mm crushed stone and HL No. 4 stone, where sufficient quantities are available for crushing. The results of the four quality tests for the most part fall within MTO specification limits for these products. MTO specification limits have been favourably modified for HL No. 4 stone and 16 mm Crushed Type A produced in the report area. Brittle and friable gneiss particles in the gravel may result in high Los Angeles Abrasion and Impact losses as well as high Hot Mix and Concrete Petrographic Numbers. The local aggregates, however, perform well in asphalt pavements in the field. For this reason, MTO has modified the aggregate specifications to permit losses up to 50 percent for the Los Angeles Abrasion and Impact test, and a maximum petrographic number of 180 for HL No. 4 stone and 16 mm Crushed Type A.

Although an aggregate source may meet published specifications, the locally produced coarse and fine aggregate is not accepted by MTO for use in Portland cement concrete which will be exposed to de-icing salts. There is a potential bonding problem between the cement and the stone which may eventually result in spalling of the concrete. Also, gravel in the northernmost townships in the area may contain abundant argillite, greywacke and sandstone clasts of the Huronian Supergroup. These rock types are alkali-reactive with Portland cement when used in structures exposed to moist conditions and de-icing salts (Rogers 1985; Magni *et al.* 1986). For concrete applications other than those exposed to high amounts of moisture and de-icing salts, the local aggregates should perform adequately assuming the gravel meets established quality criteria. The lack of crushable gravel in the project area, combined with the unsuitability of local aggregates for some concrete applications, has led to the importation of aggregate to meet some local demands.

Although most of the aggregate resources in the report area are suitable for only low specification uses, greater quantities of these low grade aggregates are required for most construction jobs relative to high specification products. Also, the low specification aggregates tend to have a low unit cost relative to transportation cost. For these reasons, it is not as economically viable to import low specification products as it is to import high grade aggregates. Consequently, deposits containing low grade aggregates are also considered valuable components of the area's resource base.

SUMMARY

The sand and gravel deposits in the Parry Sound to French River Area are the product of glacial activity which occurred during the Late Wisconsinan Substage of the Pleistocene Epoch. A number of these deposits which contain significant resources of sand and gravel have been grouped together into 28 Primary Resource Areas. In addition, numerous deposits of secondary significance which considerably add to the project area's resource base have been selected. Care should be taken to ensure the continued availability of as much of the resource areas as possible.

In general, the report area contains only limited sand and gravel resources. These resources are especially scarce in the northern part of the report area and in areas lying near the shores of Georgian Bay. Existing deposits in these areas are usually small, isolated bodies containing material suitable for low specification use. In the northern townships, large tracts of land contain little or no aggregate resources. Therefore, aggregates may have to be transported lengthy distances to supply construction needs in certain areas. Areas which have extreme shortages of usable sand and gravel include the Key Harbour Area, and Henvey, Blair, Brown, Harrison, Carling and Cowper geographic townships. Relatively more aggregate resources are available in the southern part of the project area. Subaqueous fan deposits in McDougall, Foley, Christie, Conger and Humphrey geographic townships are the major sources of aggregate in this area.

Deposits selected for possible resource protection in the report area are typically sand sources which may contain minor amounts of gravel. The aggregate is generally acceptable for low specification aggregate products including granular sub-base, septic beds and fill. Varying amounts of silt and clay may be associated with these deposits. The existence of excessively fine aggregate is the major factor limiting aggregate quality. Average thicknesses of the selected deposits generally range from 5 to 15 feet (1.5 to 5 m). Bedrock and/or the water table are likely to be encountered within 15 feet (5 m) of the surface in many of the deposits.

Supplies of crushable gravel are lacking throughout the project area and are not sufficient to meet local demand. The major source of this material is Resource Area 18 in McDougall geographic township. The gravel in the report area is generally suitable for uses including GBC A, 16 mm crushed stone and HL No. 4 stone, where it is available in sufficient quantities. Locally produced coarse and fine aggregates are not accepted, however, by MTO for use in concrete structures exposed to de-icing salts.

To counter the shortage of coarse aggregate in the areas, crushed stone is either imported or quarried locally. The local quarries are sited primarily in gneisses which are generally suitable for most usual aggregate uses except for some concrete applications.

Enquiries regarding the Aggregate Resources Inventory of the Parry Sound to French River Area should be directed to the Aggregate Assessment Office, Engineering and Terrain Geology Section, Ontario Geological Survey, Mines and Minerals Division, Ontario Ministry of Northern Development and Mines, Room M1B-45, Macdonald Block, Queen's Park, Toronto, Ontario, M7A 1W4, {Tel. (416) 965-1663}, or to the Resident Geologist, Algonquin District, Ontario Ministry of Northern Development and Mines, P.O. Box 190, Dorset, P0A 1E0, {Tel. (705) 766-2494}, or to the Parry Sound District Office, Ontario Ministry of Natural Resources, 7 Bay Street, Parry Sound, P2A 1S4, {Tel. (705) 746-4201}.

TABLE 1. TOTAL SAND AND GRAVEL RESOURCES, PARRY SOUND TO FRENCH RIVER AREA[1,2].

1 Class No.	2 Deposit Type (see Appendix C)	3 Areal Extent Acres (Hectares)	4 Original[3] Tonnage Millions of Tons (Tonnes)
BYNG INLET MAP AREA			
Key Harbour Area			
2	S-LP-SF	34 (14)	1.3 (1.2)
3	S-LP-SF	63 (25)	1.3 (1.2)
4	S-IC	28 (11)	0.3 (0.3)
	S-LP	270 (109)	3.0 (2.7)
		395 (160)	5.9 (5.4)
Henvey Geographic Township			
3	S-LP	154 (62)	3.1 (2.8)
4	S-LP	730 (295)	7.0 (6.4)
		880 (355)	10.1 (9.2)
Mowat Geographic Township			
1	S-IC	75 (30)	3.8 (3.4)
2	S-LP	122 (49)	3.7 (3.4)
	S-LP-SF	155 (63)	4.7 (4.3)
3	S-IC	93 (38)	2.3 (2.1)
	S-LP	234 (95)	4.3 (3.9)
	S-LP-SF	127 (51)	2.5 (2.3)
	S-OW	65 (26)	1.0 (0.9)
4	S-IC	7 (3)	0.1 (0.1)
	S-LP	1100 (445)	11.0 (10.0)
	S-OW	90 (36)	0.9 (0.8)
		2070 (840)	34.5 (31.5)
Blair Geographic Township			
1	G-IC	12 (5)	0.6 (0.5)
	S-LP	196 (79)	9.8 (8.9)
2	S-IC	64 (26)	1.9 (1.7)
	S-LP	395 (160)	14.6 (13.2)
3	G-IC	7 (3)	0.1 (0.1)
	G-OW	14 (6)	0.3 (0.3)
	S-IC	22 (9)	0.3 (0.3)
	S-LP	270 (109)	4.0 (3.6)
	S-LP-SF	55 (22)	1.1 (1.0)
4	G-IC	12 (5)	0.1 (0.1)
	S-IC	18 (7)	0.2 (0.2)
	S-LP	315 (127)	3.2 (2.9)
	S-OW	1 (<1)	<0.1 (<0.1)
		1380 (560)	36.0 (32.5)
Wallbridge Geographic Township			
1	G-IC	27 (11)	1.4 (1.3)
2	S-LP	345 (140)	10.8 (9.8)
	S-LP-SF	105 (42)	3.2 (2.9)
3	G-IC	10 (4)	0.2 (0.2)
	S-IC	4 (2)	0.1 (0.1)
	S-LP	189 (76)	3.1 (2.8)
	S-LP-SF	130 (53)	2.6 (2.4)
4	S-IC	21 (8)	0.2 (0.2)
	S-LP	1270 (510)	12.7 (11.5)
	S-LP-SF	130 (53)	1.3 (1.2)
		2230 (900)	35.5 (32.0)

TABLE 1. TOTAL SAND AND GRAVEL RESOURCES, PARRY SOUND TO FRENCH RIVER AREA[1,2].

1 Class No.	2 Deposit Type (see Appendix C)	3 Areal Extent Acres (Hectares)	4 Original[3] Tonnage Millions of Tons (Tonnes)
Brown Geographic Township			
3	G-IC	39 (16)	0.8 (0.7)
	S-IC	77 (31)	1.3 (1.2)
4	S-IC	32 (13)	0.3 (0.3)
	S-LP	240 (97)	2.4 (2.2)
		390 (158)	4.8 (4.4)
TOTAL FOR BYNG INLET MAP AREA:		7350 (2950)	127.0 (115.0)
POINTE AU BARIL STATION MAP AREA			
Harrison Geographic Township			
2	G-IC	8 (3)	0.2 (0.2)
	S-IC	13 (5)	0.4 (0.4)
	S-LP-SF	13 (5)	0.4 (0.4)
3	S-IC	8 (3)	0.1 (0.1)
	S-LP	115 (46)	1.8 (1.6)
	S-LP-SF	8 (3)	0.2 (0.2)
4	S-IC	5 (2)	<0.1 (<0.1)
	S-LP	810 (330)	8.1 (7.3)
		980 (395)	11.2 (10.2)
Shawanaga Geographic Township			
2	S-IC	7 (3)	0.2 (0.2)
	S-LP-SF	415 (168)	13.4 (12.2)
3	S-IC	11 (4)	0.2 (0.2)
	S-LP	143 (58)	2.4 (2.2)
	S-LP-SF	190 (77)	3.3 (3.0)
4	S-IC	15 (6)	0.1 (0.1)
	S-LP	790 (320)	7.9 (7.2)
	S-LP-SF	20 (8)	0.2 (0.2)
		1590 (640)	27.5 (25.0)
Carling Geographic Township[4]			
2	S-IC	19 (8)	0.6 (0.5)
3	S-IC	87 (35)	1.1 (1.0)
	S-LP	485 (196)	7.2 (6.5)
	S-LP-SF	100 (40)	2.0 (1.8)
4	G-IC	154 (62)	1.2 (1.1)
	S-IC	395 (160)	4.0 (3.6)
	S-LP	850 (345)	8.4 (7.6)
		2090 (850)	24.5 (22.2)
Ferguson Geographic Township			
2	S-LP	11 (4)	0.3 (0.3)
	S-LP-SF	201 (81)	6.0 (5.4)
3	S-IC	64 (26)	1.3 (1.2)
	S-LP	36 (15)	0.5 (0.4)
	S-LP-SF	104 (42)	2.1 (1.9)
4	S-IC	265 (107)	2.6 (2.4)
	S-LP	800 (325)	8.2 (7.4)
	S-LP-SF	310 (126)	3.1 (2.8)
		1810 (730)	24.1 (21.9)

TABLE 1. TOTAL SAND AND GRAVEL RESOURCES, PARRY SOUND TO FRENCH RIVER AREA[1,2].

1 Class No.	2 Deposit Type (see Appendix C)	3 Areal Extent Acres (Hectares)	4 Original[3] Tonnage Millions of Tons (Tonnes)
TOTAL FOR POINTE AU BARIL STATION MAP AREA:			
		6500 (2650)	87.0 (79.0)
PARRY SOUND MAP AREA			
McDougall Geographic Township			
1	S-IC	3 (1)	0.2 (0.2)
	S-LP	15 (6)	0.8 (0.7)
	S-LP-SF	200 (81)	11.1 (10.1)
2	S-IC	34 (14)	1.3 (1.2)
	S-LP	35 (14)	1.0 (0.9)
	S-LP-SF	156 (63)	4.6 (4.2)
3	S-IC	56 (23)	1.0 (0.9)
	S-LP	790 (320)	14.2 (12.9)
	S-LP-SF	65 (26)	1.1 (1.0)
4	S-IC	880 (355)	8.5 (7.7)
	S-LP	1140 (460)	11.8 (10.7)
	S-LP-SF	219 (89)	2.2 (2.0)
		3600 (1460)	58.0 (53.0)
Foley Geographic Township			
2	S-IC	30 (12)	1.0 (0.9)
	S-LP	35 (14)	1.3 (1.2)
	S-LP-SF	350 (142)	13.7 (12.4)
3	S-IC	47 (19)	0.7 (0.6)
	S-LP	216 (87)	3.5 (3.2)
	S-LP-SF	108 (44)	2.2 (2.0)
4	S-IC	850 (345)	8.5 (7.7)
	S-LP	1240 (500)	12.4 (11.2)
	S-LP-SF	510 (206)	5.1 (4.6)
	S-OW	45 (18)	0.4 (0.4)
		3450 (1400)	49.0 (44.5)
Christie Geographic Township			
1	S-LP-SF	120 (49)	6.8 (6.2)
2	G-IC	10 (4)	0.2 (0.2)
	S-IC	86 (35)	2.6 (2.4)
	S-LP-SF	730 (295)	23.0 (20.9)
3	S-IC	24 (10)	0.4 (0.4)
	S-LP	460 (186)	8.8 (8.0)
	S-LP-SF	360 (146)	7.5 (6.8)
4	S-AL	43 (17)	0.4 (0.4)
	S-IC	395 (160)	4.0 (3.6)
	S-LP	1120 (455)	11.2 (10.2)
	S-LP-SF	139 (56)	1.4 (1.3)
		3600 (1420)	66.0 (60.0)
Cowper Geographic Township			
2	S-LP-SF	33 (13)	1.0 (0.9)
3	S-LP	42 (17)	0.6 (0.5)
	S-LP-SF	1 (<1)	<0.1 (<0.1)
4	S-IC	285 (115)	2.8 (2.5)
	S-LP	206 (83)	2.1 (1.9)
		570 (231)	6.5 (5.9)

TABLE 1. TOTAL SAND AND GRAVEL RESOURCES, PARRY SOUND TO FRENCH RIVER AREA[1,2].

1 Class No.	2 Deposit Type (see Appendix C)	3 Areal Extent Acres (Hectares)	4 Original[3] Tonnage Millions of Tons (Tonnes)
Conger Geographic Township			
1	G-IC	8 (3)	0.4 (0.4)
	S-IC	9 (4)	0.4 (0.4)
	S-LP-SF	130 (53)	6.5 (5.9)
2	G-IC	8 (3)	0.3 (0.3)
	S-LP-SF	365 (148)	11.9 (10.8)
3	S-IC	32 (13)	0.5 (0.4)
	S-LP	157 (64)	2.7 (2.4)
	S-LP-SF	148 (60)	2.5 (2.3)
4	S-IC	630 (255)	6.3 (5.7)
	S-LP	1750 (710)	14.4 (13.1)
	S-LP-SF	166 (67)	1.6 (1.4)
		3400 (1380)	47.5 (43.0)
Humphrey Geographic Township			
1	S-IC	7 (3)	0.3 (0.3)
	S-LP-SF	12 (5)	0.6 (0.5)
2	S-IC	44 (18)	1.1 (1.0)
	S-LP	18 (7)	0.5 (0.5)
	S-LP-SF	700 (285)	21.3 (19.3)
3	S-IC	112 (45)	2.0 (1.8)
	S-LP	145 (59)	2.4 (2.2)
	S-LP-SF	420 (170)	7.9 (7.2)
4	S-IC	95 (38)	0.9 (0.8)
	S-LP	830 (335)	8.3 (7.5)
	S-LP-SF	138 (56)	1.4 (1.3)
		2500 (1010)	46.5 (42.0)
TOTAL FOR PARRY SOUND MAP AREA:		17,000 (6900)	275.0 (250.0)
TOTAL FOR STUDY AREA:		31,000 (12 500)	490.0 (445.0)

[1] *Identified deposit areas within the town of Parry Sound, village of Rosseau, and Grundy Lake, Killbear, Oastler Lake and Sturgeon Bay Provincial Parks, and Round Lake Provincial Nature Reserve, and all Indian Reserves, are omitted on all tables.*

[2] *For clarity, the information is cited in all tables on the basis of geographic townships. The relationships between the geographic townships and the municipal townships are explained in the text (see Location and Population Section), and are shown in Figure 2.*

[3] *For practical purposes, the Original Tonnage and Available Aggregate figures for this project area have been shown to the nearest decimal place, because of the small amounts of material present in some deposits.*

[4] *A small portion of Carling geographic township (Depot Harbour) appears in the Parry Sound Map Area (Map C), but is accounted for in all the tables with the remainder of the township, as part of the Pointe au Baril Station Map Area (Map B).*

N.B. Minor variations in all tables are caused by rounding of data.

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
BYNG INLET MAP AREA						
Key Harbour Area						
1	K5-6	unsubdivided portion		10-20 (3-6)	-	medium to coarse sand, near depletion
Henvey Geographic Township						
2	K5-4	6	6	5-8 (1.5-2)	0	medium sand, bedrock exposed in pit floor, water on pit floor
3	-	9	3	<5 (<1.5)	0	clean medium sand, high water table in area
4	-	8	2	<5 (<1.5)	-	clean medium sand, bedrock exposed in pit floor, water on pit floor, near depletion
Mowat Geographic Township						
5	-	12	19	5 (1.5)	0	fine to medium sand
6	-	12	19	8 (2)	0	medium sand
7	-	2	17	5 (1.5)	5-10	coarse sand with very fine gravel
8	-	1	18	8 (2)	-	sand, near depletion
9	-	1	18	<5 (<1.5)	-	coarse sand, near depletion
10	-	7	15	20-25 (6-8)	30	sand with fine gravel
11	-	35	14	5-8 (1.5-2)	-	sand, near depletion
12	-	31	13	10 (3)	0	medium sand
13	-	31	14	<5 (<1.5)	-	sand, overgrown
14	K5-18	21	8	5-20 (1.5-6)	0-30	bedrock exposed in pit floor, water on pit floor in places, near depletion
15	-	13	7	<5 (<1.5)	-	medium sand, overgrown
16	-	1	8	<5 (<1.5)	<5	medium sand with minor amounts of fine gravel, bedrock exposed in pit floor
17	-	10	9	-	-	depleted sand source, extracted to bedrock
18	N14-18	9	9	10-15 (3-5)	-	depleted sand source, extracted to bedrock
19	-	4	8	-	-	pit depleted
20	-	23	7	5-10 (1.5-3)	-	sandy fine gravel, overgrown

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
21	–	19	6	<5 (<1.5)	0	medium sand, bedrock exposed in pit floor, water on floor
22	–	13	5	5 (1.5)	–	fine sand with minor medium sand, bedrock in one face
23	–	2	5	5–8 (1.5–2)	0	fine to medium sand, bedrock exposed in pit floor, water on floor
24	–	1	5	5 (1.5)	–	mainly fine to medium sand over bedrock or the water table
Blair Geographic Township						
25	–	unsubdivided portion		8 (2)	30–40	mainly sandy fine gravel
26	–	unsubdivided portion		10 (3)	–	mainly coarse sand, one face reveals 10 feet (3 m) of silt
27	–	unsubdivided portion		6 (2)	–	sand, depleted, extracted to bedrock
28	–	unsubdivided portion		15 (5)	–	depleted, extracted to bedrock
29	–	unsubdivided portion		–	–	depleted, extracted to bedrock
30	–	unsubdivided portion		8 (2)	0	medium sand
31	–	unsubdivided portion		5–20 (1.5–6)	variable	varies from boulders to sand
32	–	unsubdivided portion		6 (2)	20	sand with fine gravel, silt seams
33	–	unsubdivided portion		5–8 (1.5–2)	60–70	flanks bedrock ridge, near depletion
34	–	unsubdivided portion		5 (1.5)	0	medium sand, becomes silty beneath pit floor
35	–	unsubdivided portion		5 (1.5)	–	till
36	–	unsubdivided portion		<5 (<1.5)	–	sandy gravel, overgrown, bedrock in pit floor, near depletion
37	–	unsubdivided portion		<5 (<1.5)	0	fine to medium sand
38	N14–26	unsubdivided portion		20–25 (6–8)	40–70	silt seams, till layers in places
39	–	unsubdivided portion		–	–	depleted

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
40	–	unsubdivided portion		6 (2)	–	medium sand, depleted, extracted to bedrock
41	–	unsubdivided portion		10–15 (3–5)	<10	medium to coarse sand, numerous boulders at surface, occasional limestone clast
42	–	unsubdivided portion		10 (3)	0	medium sand, numerous boulders at surface, occasional limestone clast
43	–	unsubdivided portion		–	–	depleted, extracted to bedrock
44	–	unsubdivided portion		–	–	depleted, extracted to bedrock
45	N14–13	unsubdivided portion		10–12 (3–4)	–	mainly sand
46	–	unsubdivided portion		–	0	sand, pit floor flooded
47	N14–25	unsubdivided portion		5–15 (1.5–5)	0–50	series of small pits
48	–	unsubdivided portion		<5 (<1.5)	0	medium sand, bedrock exposed in floor
49	N14–27	unsubdivided portion		4–8 (1–2)	<5	fine to coarse sand, minor fine gravel
Wallbridge Geographic Township						
50	–	unsubdivided portion		4–7 (1–2)	0	sand, water on pit floor
51	8	38	2	<5 (<1.5)	0	3 feet (1 m) of sand underlain by silt and clay
52	P27–11	37	2	4–15 (1–5)	<10	bedrock exposed in faces
53	8	30	2	12 (4)	0	fine sand, bedrock exposed in one face
54	P27–13	29	2	4–12 (1–4)	–	mainly sand, active dredging of gravelly sand from below the water table in places, bedrock exposed in floor and face
55	–	28	1	2–8 (1–2)	<5	bedrock exposed in places in floor and faces, near depletion
56	–	25	1	<5 (<1.5)	<15	near depletion
57	–	28	2	8 (2)	15–80	gravel below water table
58	–	23	2	10 (3)	<5	4-foot (1 m) clay seam in one section, bedrock exposed in face, near depletion

TABLE 2: SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
59	-	21	4	10 (3)	0	fine to medium sand interbedded with silty fine sand
60	-	19	3	8 (2)	<10	bedrock exposed in faces, water on floor, near depletion
61	-	19	4	<5 (<1.5)	variable	variable material above water table, gravelly sand below water table
62	-	17	5	5 (1.5)	<15	bedrock exposed in face, depleted
63	-	10	3	8 (2)	0-20	water on pit floor
64	-	9	3	4-15 (1-5)	0-35	mainly fine to medium sand, one thick silt and clay layer, water on floor, bedrock exposed in floor
65	-	2	12	12-25 (4-8)	0-70	active extraction for resource access road construction
Brown Geographic Township						
66	-	35	12	8 (2)	variable	poorly sorted gravel, water on pit floor
67	-	31	11	10 (3)	<10	4 feet (1 m) of silt over coarse sand with fine gravel
68	-	34	9	5-8 (1.5-2)	35-55	water on floor
69	-	34	9	10 (3)	10	irregularly bedded, silty fine to coarse sand
POINTE AU BARIL STATION MAP AREA						
Harrison Geographic Township						
70	P27-15	31	11	-	-	overgrown
71	-	33	10	<5 (<1.5)	-	sand, depleted
72	-	33	9	<5 (<1.5)	-	2 feet (0.6 m) of sand over clay, bedrock exposed in faces and floor, water on floor, depleted
73	-	33	9	<5 (<1.5)	-	4 feet (1 m) of sand over clay, bedrock exposed in faces, water on floor, depleted

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
74	-	31	8	8 (2)	<5	near depletion
75	-	25	10	5–10 (1.5–3)	<5	near depletion
76	-	24	10	10–15 (3–5)	variable	bedrock exposed in face, water on floor, near depletion
77	-	22	11	10 (3)	0–5	bedrock exposed in face and floor, depleted
78	-	20	11	15–20 (5–6)	35–60	bedrock exposed in face, near depletion
79	-	19	10	10–15 (3–5)	0–40	bedrock exposed in face and floor, water on floor, near depletion
80	-	17	10	3–6 (1–2)	-	mainly sand, water on floor, near depletion
81	-	11	8	5–15 (1.5–5)	0–5	
82	-	16	7	2–10 (0.6–3)	<10	overgrown, water on floor, bedrock exposed in floor, depleted
83	-	20	7	8 (2)	-	overgrown, water on floor, bedrock exposed in faces, depleted
84	-	24	6	5 (1.5)	-	till, overgrown, near depletion
85	-	29	5	15 (5)	<10	bedrock exposed in north face
86	-	33	3	6 (2)	<10	water on floor, near depletion
87	-	2	3	10 (3)	<15	
88	-	3	3	8 (2)	-	near depletion
89	-	6	2	6 (2)	<5	water on floor, near depletion
90	-	6	1	6–8 (2)	0–5	up to 2-foot (0.6 m) clay layers in one section of the pit, near depletion
91	-	7	1	10–15 (3–5)	35–40	2 feet (0.6 m) of sand over sandy gravel
Shawanaga Geographic Township						
92	-	11	8	15 (5)	0–10	bedrock exposed in floor and face
93	-	11	8	6 (2)	-	sand, graded faces
94	-	11	8	6 (2)	-	sand, graded faces

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
95	–	12	8	10 (3)	0	sand, water on floor
96	–	12	9	6–7 (2)	0–10	2-foot (0.6 m) silt and clay layer, water on floor, bedrock exposed in face and floor
97	–	13	8	15–20 (5–6)	–	mainly sand, small gravel pocket below water table, bedrock exposed in face
98	–	14	8	8 (2)	0	sand, thin clay layers, water on floor, bedrock exposed in floor and face
99	–	16	8	6–12 (2–4)	–	mainly sand, water on floor, bedrock exposed in faces and floor
100	P27–43	19	9	5–10 (1.5–3)	variable	water on floor, bedrock exposed in floor
101	–	32	8	5–15 (1.5–5)	variable	pocket of clay coated gravel, water on floor, bedrock exposed in face
102	–	33	7	6 (2)	–	bedrock exposed in faces, depleted
103	–	30	7	6 (2)	–	water on floor, near depletion
104	–	28	5	20–25 (6–8)	variable	bedrock exposed in face, water on floor, depleted
105	P27–3	10	5	8–12 (2–4)	<5	water on floor, in places bedrock exposed in floor
106	–	19	2	8 (2)	<5	water on floor
107	–	17	1	8 (2)	<5	overgrown
Carling Geographic Township						
108	–	43	9	<5 (<1.5)	–	mainly medium sand, water on pit floor
109	–	39	7	<5 (<1.5)	–	largely medium to coarse sand
110	–	37	7	<5 (<1.5)	0	medium sand, bedrock exposed in pit floor
111	–	39	6	<5 (<1.5)	0	medium sand with some coarse sand
112	–	35	5	<5 (<1.5)	0	medium sand
113	P5–50	32	6	<5 (<1.5)	–	medium sand, depleted, extracted to bedrock
114	–	31	5	<5 (<1.5)	0	silty fine to medium sand, high water table

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
115	-	40	1	-	-	depleted, extracted to bedrock
116	-	74	11	-	-	depleted, extracted to bedrock
117	-	74	11	<5 (<1.5)	0	fine to medium sand, two feet (0.6 m) of clay overlies sand in one face
118	-	71	12	5 (1.5)	0	fine to coarse sand
119	-	65	8	5 (1.5)	<10	bedrock in pit floor, high water table
120	-	23	1	5-8 (1.5-2)	-	medium sand flanking till
121	-	23	2	5 (1.5)	-	medium sand, depleted, extracted to bedrock
122	-	18	2	<5 (<1.5)	0	fine to medium sand, bedrock in pit floor, high water table
123	-	17	2	5-12 (1.5-4)	0-15	mainly fine to medium sand, bedrock in pit floor, high water table
124	-	16	2	8-10 (2-3)	-	fine to medium sand against bedrock, depleted, water on pit floor
125	-	52	10	8-10 (2-3)	-	till
126	-	51	11	-	-	depleted, extracted to bedrock
127	-	45	11	<5 (<1.5)	0	medium sand with thin silt seams
128	-	45	11	5-8 (1.5-2)	-	till
129	-	12	2	-	-	depleted,extracted to bedrock
130	-	15	6	8 (2)	-	till
131	-	13	5	-	-	sand and gravel, depleted,extracted to bedrock
132	-	12	5	15 (5)	<5	largely fine sand, pockets of till
133	-	15	8	3-5 (1-1.5)	-	mainly medium sand, minor gravel, till and clay, bedrock in pit floor, high water table
134	-	15	8	<5 (<1.5)	0	medium sand
135	-	7	7	3-7 (1-2)	-	medium sand, 5 feet (1.5 m) of till overlies sand in one face

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
Ferguson Geographic Township						
136	P5-11	33	1	5 (1.5)	0	sand, bedrock exposed in floor
137	-	11	9	4-8 (1-2)	<5	occasional thin silt and clay layers, water on floor
138	-	2	9	10 (3)	variable	sand with pockets of gravel, bedrock exposed in floor
139	-	7	6	7-15 (2-5)	0	sand, bedrock exposed in floor and faces
140	-	8	5	7 (2)	0	sand, 1-foot (0.3 m) clay layer over sand
141	-	8	5	6-8 (2)	0	sand, up to 3 feet (1 m) of clay over sand
142	-	8	5	10 (3)	0	sand, bedrock exposed in floor and face
143	-	9	4	8-40 (2-12)	variable	mainly sand with a 15-foot (5 m) thick gravel pocket, overlain in parts by up to 6 feet (2 m) of clay
144	-	12	5	8 (2)	<5	2 feet (0.6 m) of silt and clay over sand, water on floor, partially overgrown
145	-	12	4	10 (3)	-	sand, 2 feet (0.6 m) of silt and clay over sand, bedrock exposed in face, partially overgrown
146	-	13	4	10-15 (3-5)	<5	mainly fine sand, southern faces of pit expose 4-foot (1 m) clay layer
147	P5-72-2	11	2	7-15 (2-5)	0-10	in northern part of pit sand is overlain by 2 feet (0.6 m) of clay, bedrock exposed in floor and face
148	P5-72-1	12	2	4-15 (1-5)	0-40	sand with gravel pocket, bedrock exposed in faces, partially overgrown
149	-	12	2	5-20 (1.5-6)	0	sand, bedrock exposed in the floor
150	-	12	1	12 (4)	-	sand, slumped faces
151	-	1	2	6 (2)	-	sand, 1-foot (0.3 m) clay over sand, overgrown
152	-	1	1	4-6 (1-2)	-	sand, depleted

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
153	-	1	1	-	-	completely overgrown
PARRY SOUND MAP AREA						
McDougall Geographic Township						
154	P5-5	13	12	9-20 (3-6)	0	sand, bedrock exposed in places, pockets of silty sand
155	P5-62	14	12	15-20 (5-6)	<5	bedrock exposed in places
156	-	16	12	9 (3)	0	sand, up to 2 feet (0.6 m) of clay overlying silty sand
157	P5-31	31	12	<5 (<1.5)	-	near depletion
158	P5-10	33	12	5 (1.5)	0	sand, bedrock exposed in floor
159	-	3	B	4-8 (1-2)	-	sand, bedrock exposed in faces, overgrown
160	-	2	A	5-8 (1.5-2)	-	depleted
161	-	21	10	<5 (<1.5)	10-15	near depletion, water on floor
162	-	19	10	10-20 (3-6)	0-40	up to 5 feet (1.5 m) of clay overlying sand and pocket of gravel
163	-	19	11	8 (2)	0	sand
164	-	18	11	5 (1.5)	0	sand
165	-	9	10	8 (2)	0-25	mainly medium sand
166	O8-17	8	11	10-12 (3-4)	-	mainly fine sand, eastern faces expose clay layers up to 2 feet (0.6 m) thick
167	-	3	11	6 (2)	0	sand
168	-	17	9	6 (2)	-	sand, overgrown
169	-	18	9	25-30 (8-9)	0-25	mainly medium to coarse sand
170	-	19	10	6 (2)	0-45	near depletion
171	-	19	10	15 (5)	variable	bedrock exposed in face
172	-	19	10	5-8 (1.5-2)	0-30	bedrock exposed in faces
173	-	20	10	6-8 (2)	<5	water on floor
174	P5-71	21	10	10-15 (3-5)	-	depleted
175	-	24	10	6-15 (2-5)	-	sand, overgrown

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
176	–	24	10	<5 (<1.5)	–	sand, overgrown
177	–	24	9	4–5 (1–1.5)	–	sand, partially overgrown
178	P5–75	25	9	3–5 (1–1.5)	–	sand, overgrown
179	–	9	A	<5 (<1.5)	0	sand, bedrock exposed in floor
180	P5–73	27	6	12 (4)	<5	bedrock exposed in faces and floor
181	–	27	6	8 (2)	<10	depleted
182	P5–74	25	6	10–15 (3–5)	<5	near depletion
183	–	24	7	10–15 (3–5)	–	depleted
184	–	23	7	10–15 (3–5)	–	depleted and overgrown
185	P5–38	20	6	6–20 (2–6)	0–30	near depletion
186	–	21	6	6–12 (2–4)	<5	worked in levels, mainly fine to medium sand
187	–	20	6	6–12 (2–4)	<5	depleted
188	–	19	6	3–10 (1–3)	<15	silt and clay layers up to 5 feet (1.5 m) thick
189	–	19	6	25–40 (8–12)	<5	6 feet (2 m) of silt and clay overlying silty sand
190	–	21	5	40–60 (12–18)	–	slumped faces, bedrock exposed in face
191	–	1	7	<5 (<1.5)	0	sand, bedrock exposed in floor and faces
192	–	1	6	25–30 (8–9)	<25 variable	near depletion
193	–	6	6	20–25 (6–8)	<5	mainly fine to medium sand
194	–	9	5	5 (1.5)	0	sand
195	–	9	5	10 (3)	0	sand, silty layers
196	–	8	5	6 (2)	–	sand, slumped faces and overgrown
197	O8–58	12	4	7–30 (2–9)	0–35	pockets of gravel overlain by up to 20 feet (6 m) of sand
198	–	13	4	15–30 (5–9)	variable	sand with gravel layers
199	O8–67	12	4	15–20 (5–6)	<5	water on floor
200	–	15	4	7 (2)	0–20	bedrock exposed in faces

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
201	O8-34	15	3	15-35 (5-11)	variable	pockets of gravel overlain by up to 30 feet (9 m) of sand
202	-	10	2	15-25 (5-8)	<20	near depletion
203	-	3	2	5-10 (1.5-3)	0-25	water on floor
204	-	17	1	4-8 (1-2)	0	sand
205	O8-30	19	1	50-60 (15-18)	-	depleted
Foley Geographic Township						
206	-	20	12	15-20 (5-6)	0	sand with silty sand pockets
207	-	20	12	10-15 (3-5)	0-65 variable	mainly silty fine sand, medium sand to medium gravel in lower level of pit, clay layers up to 2 feet (0.6 m) thick
208	-	27	11	7 (2)	0	silty sand to fine sand
209	O8-42	20	10	35-40 (11-12)	-	depleted, extracted to bedrock
210	-	20	10	30 (9)	-	depleted, extracted to bedrock
211	-	14	10	10-15 (3-5)	0	sand, bedrock exposed in floor
212	O8-57	13	10	<5 (<1.5)	-	rehabilitated
213	-	6	11	8 (2)	-	depleted
214	-	5	10	<5 (<1.5)	-	depleted
215	O8-52	14	9	25 (8)	variable	slumped faces
216	-	136	A	8 (2)	0	sand, bedrock exposed in face and floor
217	-	27	7	4-20 (1-6)	<5	bedrock exposed in faces
218	-	136	A	6-10 (2-3)	-	overgrown
219	O8-64	136	A	8-35 (2-11)	variable	mainly silty to fine sand
220	-	16	8	5-10 (1.5-3)	variable	partially filled in
221	-	131	B	10-35 (3-11)	variable	sand with a 10-foot (3 m) thick gravel pocket
222	40	131	B	10 (3)	0	sand
223	-	133	B	15-20 (5-6)	<5	primarily sand

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
224	-	132	B	10-15 (3-5)	0	mainly fine to medium sand
225	O8-28	131	A	10 (3)	0	mainly silty sand, 4-foot (1 m) thick clay layer in one face
226	-	127	A	<5 (<1.5)	<25	depleted
227	-	32	5	8-10 (2-3)	-	overgrown
228	-	32	3	10 (3)	<5	mainly silty fine to medium sand
229	-	32	2	10 (3)	0-50	sand with 6-foot (2 m) thick gravel pocket
230	-	30	2	4-10 (1-3)	<10	mainly silty fine to medium sand
231	-	24	3	<5 (<1.5)	-	overgrown
232	-	24	3	10 (3)	0	fine to medium sand
233	-	18	3	20 (6)	10-80 variable	mainly fine gravel
234	-	18	3	10-25 (3-8)	0-40	
235	-	14	2	10-15 (3-5)	variable	bedrock exposed in face and floor
236	-	12	3	4-6 (1-2)	0-30	bedrock exposed in face
237	-	12	3	5 (1.5)	0	sand
238	-	11	1	4-15 (1-5)	0	sand, bedrock exposed in face
239	-	10	1	6-20 (2-6)	<5	mainly medium to coarse sand
240	-	9	3	20 (6)	0	sand, bedrock exposed in face
241	-	120	A	10-35 (3-11)	<5	bedrock exposed in face
242	-	120	B	30-35 (9-11)	-	depleted, extracted to bedrock
243	O8-7	115	A	10-20 (3-6)	0	sand, bedrock exposed in face
244	O8-25	115	A	10 (3)	0	sand
Christie Geographic Township						
245	-	21	14	5 (1.5)	-	medium to coarse sand with trace amounts of fine gravel
246	-	16	14	5 (1.5)	0	fine to medium sand, bedrock in pit floor
247	-	16	14	<5 (<1.5)	0	sand

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
248	-	19	13	10 (3)	0	fine to medium sand with silty fine sand units, up to 4 feet (1.2 m) of clay overlies the aggregate in one face
249	-	18	13	10-20 (3-6)	0	4 feet (1.2 m) of clay over 5 to 11 feet (1.5 to 3 m) of fine to medium sand over coarse sand
250	-	16	12	<5 (<1.5)	0	medium sand
251	-	1	12	6 (2)	0	clean, medium to coarse sand
252	-	12	10	10-15 (3-5)	-	5 feet (1.5 m) of silty fine to medium sand over clean fine to coarse sand, one isolated gravel pocket
253	-	12	10	7 (2)	-	3 feet (1 m) till over slumped sandy gravel and gravelly sand
254	-	14	9	15 (5)	<5	clean coarse sand with minor amounts of fine gravel
255	-	14	8	5-10 (1.5-3)	0	sand, bedrock in floor
256	-	14	8	<5 (<1.5)	0	clean medium sand, minor amounts of coarse sand
257	-	14	8	10-18 (3-6)	0-30	mainly sand, gravel pockets in one section of the pit
258	-	15	8	5-10 (1.5-3)	0	fine to coarse sand, occasional silt seams
259	-	15	8	5-8 (1.5-2)	<5	clean medium to coarse sand
260	-	15	8	5-8 (1.5-2)	<5	mainly clean, medium to coarse sand, bedrock in floor
261	-	15	7	5-10 (1.5-3)	<5	mainly clean, angular medium to coarse sand, bedrock in floor
262	-	17	8	5-8 (1.5-2)	0	2 to 3 feet (0.6 to 1 m) of clay over medium to coarse sand
263	-	22	9	6 (2)	0	clean, fine to medium sand
264	O8-43	23	9	5-8 (1.5-2)	-	sand, depleted, extracted to bedrock
265	-	29	9	5-8 (1.5-2)	0	fine to medium sand, bedrock in face
266	-	35	9	<5 (<1.5)	-	coarse sand with fine gravel, water on pit floor

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
267	-	23	7	5 (1.5)	0	medium sand, bedrock in pit floor
268	-	24	6	5-25 (1.5-8)	-	mainly fine to medium sand, 4 feet (1.2 m) of clay overlies the aggregate in one face, one 2-foot (0.6 m) thick pocket of medium gravel, bedrock in pit floor
269	-	23	6	6 (2)	-	sand, overgrown
270	-	23	6	10-30 (3-9)	0-30	fine to coarse sand, gravel concentrated in pockets in lower levels of pit
271	-	15	6	5-15 (1.5-5)	-	mainly clean medium sand, one 6-foot (2 m) section of fine gravel, pit lies between rock knobs
272	-	15	6	5-7 (1.5-2)	0-30	
273	-	13	5	10-20 (3-6)	0-50	gravel concentrated in pit's eastern faces
274	-	15	5	10-15 (3-5)	<5	variably bedded fine to medium sand with gravelly sand layers and silt seams
275	-	19	4	10-15 (3-5)	0	fine to medium sand with abundant silt seams
276	-	19	4	10-15 (3-5)	0	clean medium sand
277	-	32	4	5-8 (1.5-2)	0-30	one excavation reveals medium sand and another exposes gravelly sand
278	-	32	4	9 (3)	-	5 feet (1.5 m) of silty fine to medium sand over coarse crushable gravel
279	-	32	3	-	-	gravel, depleted, extracted to bedrock
280	-	19	3	5-20 (1.5-6)	<5	material varies from clean coarse sand with fine gravel to silty fine to medium sand
281	-	15	3	6 (2)	-	mainly medium sand, flanks bedrock
282	-	13	3	5-15 (1.5-5)	0	fine to medium sand with occasional silty very fine sand layers

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
283	–	18	1	6–10 (2–3)	0	south face reveals 6 feet (2 m) of fine sand over 4 feet (1.2 m) of clean coarse sand, north face consists of 4 feet (1.2 m) of clay over 2 feet (0.6 m) of sand
284	–	18	1	5–10 (1.5–3)	–	clean medium sand, overgrown
285	–	18	1	5–12 (1.5–4)	–	mainly fine to coarse sand. one isolated pocket of medium gravel, 3 feet (1 m) of clay overlies aggregate in south pit face
286	O8–13	21	2	8–12 (2–4)	–	mainly fine to medium sand, occasional coarse sand and gravelly sand units in lower levels, 2-foot (0.6 m) clay layer in one section, bedrock exposed, water ponded on pit floor
287	O8–38	25	1	50 (15)	0	30 feet (9 m) of fine to medium sand over 20 feet (6 m) of medium to coarse sand, pit worked in two levels
288	–	28	1	5–10 (1.5–3)	–	mainly fine to medium sand, silt and clay layers common in some sections
289	–	28	1	10–20 (3–6)	–	2 feet (0.6 m) of fine sand, silt and till over fine to medium sand
290	–	29	1	–	–	depleted, extracted to bedrock
291	–	30	1	5–7 (1.5–2)	–	till
292	–	31	1	20–25 (6–8)	–	5 feet (1.5 m) of sand over 3 feet (1 m) of clay over till
293	–	27	1	10–15 (3–5)	–	mainly medium sand, 4 feet (1.2 m) of clay overlies sand in one face
294	O8–5	30	1	10–15 (3–5)	0	clean medium sand, bedrock exposed in floor in one section of pit
295	–	31	1	–	–	sand, depleted, extracted to bedrock

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
296	–	31	1	5–10 (1.5–3)	–	4 feet (1.2 m) of fine sand, silt and clay over up to 3 feet (1 m) of medium to coarse sand over till
Conger Geographic Township						
297	–	40	3	<5 (<1.5)	0	fine to medium sand
298	–	33	9	20–25 (6–8)	35–50	2 feet (0.6 m) of clay overlies sandy fine to medium gravel
299	–	29	6	5–15 (1.5–5)	–	fine to medium sand, active extraction from below the water table, clay layer
300	L14–71	28	6	8–15 (2–5)	–	mainly fine to medium sand, occasional silty fine sand units
301	–	27	6	7 (2)	0	fine sand, bedrock in floor
302	–	26	8	5 (1.5)	0	medium sand with minor fine sand, a 1-foot (0.3 m) clay layer observed near base of pit
303	L14–81	22	7	15 (5)	0–50	mainly fine to medium sand, gravel concentrated in pockets in lower levels of eastern faces
304	–	21	6	5–8 (1.5–2)	–	clean fine to medium sand, overgrown
305	L14–76	21	6	5–10 (1.5–3)	0	clean fine to medium sand
306	–	21	3	5–10 (1.5–3)	<20	mainly fine to medium sand over bedrock
307	–	20	3	5 (1.5)	–	sand, depleted, extracted to bedrock
308	–	19	2	5–10 (1.5–3)	–	till over bedrock
309	–	15	3	5–8 (1.5–2)	–	clay over gravel, faces slumped and overgrown
310	L14–73	15	4	10–20 (3–6)	40–50	3 feet (1 m) of clay overlies the gravel in some sections
311	L14–10	5	1	5–15 (1.5–5)	0	2 feet (0.6 m) of clay over fine to medium sand with silt seams, coarse sand has been dredged from beneath the water table

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
312	–	23	10	–	–	sand, depleted, extracted to bedrock
313	–	22	10	8–10 (2–3)	–	1-foot (0.3 m) of clay over coarse sand with minor amounts of fine gravel
314	–	22	10	5–10 (1.5–3)	–	predominantly fine to medium sand, some silty fine sand and coarse sand units, one isolated gravel pocket
315	–	21	10	5–15 (1.5–5)	0–30	medium to coarse sand, some sandy gravel and silty fine sand layers, 3 feet (1 m) of clay overlies sand in one pit face
316	–	19	10	–	–	sahd, depleted, extracted to bedrock
317	–	18	9	20 (6)	–	1.5 feet (0.5 m) of clay over slumped fine to medium sand
318	–	18	9	10–20 (3–6)	–	varies from fine sand with silt lenses to coarse sand, one gravelly sand pocket, bedrock in pit floor
319	–	17	10	5–8 (1.5–2)	–	slumped, overgrown
320	–	18	10	10–12 (3–4)	0–50	silty fine to medium sand overlying 5 feet (1.5 m) of fine gravel at base of pit, bedrock in pit floor
321	–	18	10	10–15 (3–5)	0–60	mainly clean medium sand, 5-foot (1.5 m) thick pocket of fine gravel at base of pit, bedrock in pit floor
322	–	17	10	10–12 (3–4)	0–40	silty fine to medium sand over 4 feet (1.2 m) of fine to medium gravel, bedrock in pit face
323	–	17	10	6–15 (2–5)	<5	1-foot (0.3 m) of silty fine sand over clean medium sand
324	–	14	12	8–20 (2–6)	<5	mainly silty fine to medium sand, occasional gravel pockets, 3-foot (1 m) thick clay layer
325	–	13	12	30 (9)	0	2 feet (0.6 m) of clay over medium to coarse sand

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
326	-	10	7	<5 (<1.5)	-	fine to medium sand with minor gravel
327	-	2	8	10 (3)	0	5 feet (1.5 m) of medium sand over silty fine sand
328	L14-72	1	8	10-15 (3-5)	0	fine to medium sand with common silt seams
329	-	1	9	8-10 (2-3)	-	medium to coarse sand with minor fine gravel, 2-foot (0.6 m) clay layer, bedrock in pit floor
330	-	1	9	5-6 (1.5-2)	-	medium to coarse sand, common silt layers, 2-foot (0.6 m) thick gravel pockets
331	L14-11	3	9	15-20 (5-6)	-	medium to coarse sand with occasional gravel pockets, up to 2 feet (0.6 m) of clay overlies the sand in places, occasional fine sand units
332	-	3	10	5-8 (1.5-2)	0	clean medium sand
333	-	2	11	5-10 (1.5-3)	0	silty fine to medium sand
334	-	1	11	10-20 (3-6)	0	silty fine sand to medium sand
335	O8-01	1	11	10-25 (3-8)	0	fine sand with some medium sand, occasional silt and clay seams
Humphrey Geographic Township						
336	-	35	11	5-15 (1.5-5)	0	fine sand, some medium sand and silt layers, bedrock in pit floor
337	-	35	12	-	-	rehabilitated
338	-	35	12	-	-	rehabilitated
339	O8-11 O8-63	35	13	10-15 (3-5)	-	fine to medium sand, also silt, clay and gravelly sand seams
340	-	32	13	5-15 (1.5-5)	0	fine to coarse sand, occasional silt and clay seams
341	-	33	13	5-10 (1.5-3)	0-25	mainly silty fine to medium sand, coarse sand with some gravel near base of pit
342	-	32	12	5-8 (1.5-2)	0	mainly silty fine to medium sand
343	-	32	12	<5 (<1.5)	0	clean medium sand

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
344	–	33	11	15 (5)	–	mainly medium sand
345	–	34	9	8–10 (2–3)	0	fine sand
346	–	34	8	5 (1.5)	0	medium sand
347	–	35	4	5–15 (1.5–5)	0	mainly medium sand, common fine sand and silt layers in upper 5 feet (1.5 m) of faces
348	–	35	3	10–12 (3–4)	0	fine to medium sand
349	–	27	14	5–6 (1.5–2)	<5	mainly medium sand, isolated gravel lenses, bedrock in pit floor
350	–	23	14	–	–	no access
351	O8-9	96	A	5–15 (1.5–5)	–	fine sand with silt seams over clean medium sand, isolated pocket of coarse gravel
352	O8-9	96	A	8–12 (2–4)	–	fine sand with silt seams, occasional 1-foot (0.3 m) thick gravel lenses
353	–	24	10	–	–	sand, depleted, extracted to bedrock
354	–	25	10	10–15 (3–5)	0	2 feet (0.6 m) clay over 4 feet (1.2 m) silt and sand over clean, medium to coarse sand
355	O8-15	24	10	8–10 (2–3)	–	fine to medium sand, near depletion
356	–	24	10	8–10 (2–3)	0	medium sand
357	08-15	23	10	5–10 (1.5–3)	–	fine to medium sand, partially overgrown
358	–	24	9	8 (2)	0	medium sand
359	–	24	9	5–10 (1.5–3)	–	fine to medium sand, minor fine gravel and silt layers
360	–	24	9	–	–	sand, overgrown
361	O8-14	89	B	10–15 (3–5)	–	no access
362	–	8	13	10–12 (3–4)	0–40	active crushing
363	–	9	12	7–9 (2–3)	<5	3 to 4 feet (1 to 1.2 m) of fine sand over coarse sand with minor fine gravel
364	–	6	12	5 (1.5)	0	sand, flanks bedrock

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
365	–	9	10	10–12 (3–4)	0	medium sand, clay up to 6 feet (2 m) thick overlies the aggregate in sections
366	–	3	10	20–25 (6–8)	5–10	fine to medium sand flanking bedrock, near depletion
367	–	4	10	5–10 (1.5–3)	0	medium to coarse sand, up to 3 feet (1 m) of clay overlies the aggregate in some sections
368	–	5	10	8–10 (2–3)	–	fine to medium sand, near depletion
369	–	7	10	10–20 (3–6)	variable	mainly sand, occasional sandy gravel layers, variable amounts of silt and clay
370	–	79	B	<5 (<1.5)	0	sand
371	–	83	B	5–8 (1.5–2)	0	fine to medium sand, 3 feet (1 m) of clay overlies the aggregate in the eastern pit faces
372	–	79	A	8–10 (2–3)	–	3 to 4 feet (1 to 1.2 m) of gravelly sand over medium sand, near depletion
373	–	78	A	10–15 (3–5)	0	medium sand flanking bedrock
374	–	74	A	10–12 (3–4)	15–25	5 feet (1.5 m) of clay over sand and gravel
375	–	7	6	10 (3)	0	clean medium sand
376	–	7	6	5 (1.5)	<5	medium to coarse sand with minor fine gravel, occasional clay layers
377	–	13	6	5–8 (1.5–2)	0–45	fine to medium sand with gravel layers, clay seams, near depletion
378	–	18	5	8–12 (2–4)	0	silty fine to coarse sand, common silt and clay seams
379	–	18	5	–	–	depleted to bedrock
380	–	18	4	–	–	depleted to bedrock
381	–	18	4	8–10 (2–3)	0	fine to medium sand, common silt seams
382	–	13	5	–	–	near depletion
383	–	16	4	5–18 (1.5–6)	–	fine to medium sand, silt and clay layers, near depletion

TABLE 2. SAND AND GRAVEL PITS, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 % GRAVEL	7 REMARKS
384	-	20	1	5–8 (1.5–2)	0	medium sand, bedrock in floor
385	-	9	3	<5 (<1.5)	0	medium sand
386	-	4	3	20–25 (6–8)	-	clay over till
387	-	4	2	-	-	sand, depleted, extracted to bedrock

TABLE 3. SELECTED SAND AND GRAVEL RESOURCE AREAS, PARRY SOUND TO FRENCH RIVER AREA.

1 DEPOSIT NO.	2 UNLICENCED AREA Acres (Hectares)	3 CULTURAL SETBACKS Acres (Hectares)	4 EXTRACTED AREA Acres (Hectares)	5 AVAILABLE AREA Acres (Hectares)	6 ESTIMATED DEPOSIT THICKNESS Feet (Metres)	7 AVAILABLE[1] AGGREGATE Millions of Tons (Tonnes)
BYNG INLET MAP AREA						
Key Harbour Area						
			- NONE -			
Henvey Geographic Township						
			- NONE -			
Mowat Geographic Township						
1	41 (17)	5 (2)	1 (<1)	35 (14)	15 (5)	1.3 (1.2)
2	65 (26)	24 (10)	1 (<1)	40 (16)	6 (2)	0.6 (0.5)
3	75 (30)	3 (1)	2 (1)	70 (28)	20 (6)	3.5 (3.2)
4	120 (49)	12 (5)	8 (3)	100 (40)	8 (2)	2.0 (1.8)
	300 (121)	44 (18)	12 (5)	245 (99)		7.4 (6.7)
Blair Geographic Township						
5	42 (17)	5 (2)	2 (1)	35 (14)	12 (4)	1.0 (0.9)
6	55 (22)	0 (0)	0 (0)	55 (22)	8 (2)	1.1 (1.0)
	97 (39)	5 (2)	2 (1)	90 (36)		2.1 (1.9)
Wallbridge Geographic Township						
7	105 (42)	15 (6)	20 (8)	70 (28)	12 (4)	2.1 (1.9)
8	130 (53)	3 (1)	2 (1)	125 (51)	8 (2)	2.5 (2.3)
9	27 (11)	0 (0)	7 (3)	20 (8)	20 (6)	1.0 (0.9)
	260 (105)	18 (7)	29 (12)	215 (87)		5.6 (5.1)
Brown Geographic Township						
10a	7 (3)	0 (0)	1 (<1)	6 (2)	8 (2)	0.1 (0.1)
10b	16 (6)	0 (0)	1 (<1)	15 (6)	8 (2)	0.3 (0.3)
10c	31 (12)	0 (0)	1 (<1)	30 (12)	8 (2)	0.6 (0.5)
	54 (22)	0 (0)	3 (1)	51 (21)		1.0 (0.9)
TOTAL FOR BYNG INLET MAP AREA:						
	710 (285)	67 (27)	46 (19)	600 (243)		16.1 (14.6)

TABLE 3. SELECTED SAND AND GRAVEL RESOURCE AREAS, PARRY SOUND TO FRENCH RIVER AREA.

1 DEPOSIT NO.	2 UNLICENCED AREA Acres (Hectares)	3 CULTURAL SETBACKS Acres (Hectares)	4 EXTRACTED AREA Acres (Hectares)	5 AVAILABLE AREA Acres (Hectares)	6 ESTIMATED DEPOSIT THICKNESS Feet (Metres)	7 AVAILABLE[1] AGGREGATE Millions of Tons (Tonnes)
POINTE AU BARIL STATION MAP AREA						
Harrison Geographic Township						
			- NONE -			
Shawanaga Geographic Township						
11	20 (8)	0 (0)	0 (0)	20 (8)	8 (2)	0.4 (0.4)
12	225 (91)	30 (12)	15 (6)	180 (73)	12 (4)	5.4 (4.9)
13	80 (32)	28 (11)	7 (3)	45 (18)	6 (2)	0.7 (0.6)
14a	155 (63)	0 (0)	15 (6)	140 (57)	15 (5)	5.2 (4.8)
14b	35 (14)	0 (0)	0 (0)	35 (14)	10 (3)	0.9 (0.8)
	190 (77)	0 (0)	15 (6)	175 (71)		6.1 (5.5)
	520 (210)	58 (23)	37 (15)	420 (170)		12.6 (11.4)
Carling Geographic Township						
15a	50 (20)	0 (0)	10 (4)	40 (16)	5 (1.5)	0.5 (0.4)
15b	100 (40)	35 (14)	30 (12)	35 (14)	8 (2)	0.7 (0.6)
	150 (61)	35 (14)	40 (16)	75 (30)		1.2 (1.1)
Ferguson Geographic Township						
16a	90 (36)	40 (16)	5 (2)	45 (18)	8 (2)	0.9 (0.8)
16b	18 (7)	1 (<1)	2 (1)	15 (6)	15 (5)	0.6 (0.5)
16c	130 (53)	50 (20)	10 (4)	70 (28)	12 (4)	2.1 (1.9)
	238 (96)	91 (37)	17 (7)	130 (53)		3.6 (3.3)
TOTAL FOR POINTE AU BARIL STATION MAP AREA:						
	910 (370)	184 (74)	94 (38)	620 (250)		17.4 (15.8)
PARRY SOUND MAP AREA						
McDougall Geographic Township						
16c	125 (51)	35 (14)	25 (10)	65 (26)	12 (4)	2.0 (1.8)

TABLE 3. SELECTED SAND AND GRAVEL RESOURCE AREAS, PARRY SOUND TO FRENCH RIVER AREA.

1 DEPOSIT NO.	2 UNLICENCED AREA Acres (Hectares)	3 CULTURAL SETBACKS Acres (Hectares)	4 EXTRACTED AREA Acres (Hectares)	5 AVAILABLE AREA Acres (Hectares)	6 ESTIMATED DEPOSIT THICKNESS Feet (Metres)	7 AVAILABLE[1] AGGREGATE Millions of Tons (Tonnes)
17	15 (6)	1 (<1)	3 (1)	11 (4)	20 (6)	0.6 (0.5)
18a	115 (46)	10 (4)	25 (10)	80 (32)	20 (6)	4.0 (3.6)
18b	50 (20)	15 (6)	10 (4)	25 (10)	25 (8)	1.6 (1.5)
18c	25 (10)	5 (2)	0 (0)	20 (8)	12 (4)	0.6 (0.5)
	190 (77)	30 (12)	35 (14)	125 (51)		6.2 (5.6)
	330 (134)	66 (27)	63 (26)	201 (81)		8.8 (8.0)
Foley Geographic Township						
19	42 (17)	7 (3)	5 (2)	30 (12)	15 (5)	1.1 (1.0)
20	125 (51)	40 (16)	15 (6)	70 (28)	15 (5)	2.6 (2.4)
21	33 (13)	10 (4)	3 (1)	20 (8)	12 (4)	0.6 (0.5)
	200 (81)	57 (23)	23 (9)	120 (49)		4.3 (3.9)
Christie Geographic Township						
22a	50 (20)	15 (6)	5 (2)	30 (12)	15 (5)	1.1 (1.0)
22b	55 (22)	0 (0)	10 (4)	45 (18)	10 (3)	1.1 (1.0)
22c	70 (28)	5 (2)	15 (6)	50 (20)	9 (3)	1.1 (1.0)
22d	37 (15)	0 (0)	2 (1)	35 (14)	25 (8)	2.2 (2.0)
	212 (86)	20 (8)	32 (13)	160 (65)		5.5 (5.0)
23a	23 (9)	0 (0)	3 (1)	20 (8)	15 (5)	0.8 (0.7)
23b	17 (7)	0 (0)	0 (0)	17 (7)	8 (2)	0.3 (0.3)
23c	10 (4)	0 (0)	3 (1)	7 (3)	10 (3)	0.2 (0.2)
	50 (20)	0 (0)	6 (2)	44 (18)		1.3 (1.2)
24a	275 (111)	20 (8)	20 (8)	235 (95)	12 (4)	7 (6.4)
24b	15 (6)	0 (0)	1 (<1)	14 (6)	30 (9)	1.0 (0.9)

TABLE 3. SELECTED SAND AND GRAVEL RESOURCE AREAS, PARRY SOUND TO FRENCH RIVER AREA.

1 DEPOSIT NO.	2 UNLICENCED AREA Acres (Hectares)	3 CULTURAL SETBACKS Acres (Hectares)	4 EXTRACTED AREA Acres (Hectares)	5 AVAILABLE AREA Acres (Hectares)	6 ESTIMATED DEPOSIT THICKNESS Feet (Metres)	7 AVAILABLE[1] AGGREGATE Millions of Tons (Tonnes)
24c	15 (6)	0 (0)	0 (0)	15 (6)	20 (6)	0.8 (0.7)
	305 (123)	20 (8)	21 (8)	265 (107)		8.8 (8.0)
	570 (231)	40 (16)	59 (24)	470 (190)		15.6 (14.2)
Cowper Geographic Township						
			- NONE -			
Conger Geographic Township						
25a	8 (3)	0 (0)	1 (<1)	7 (3)	20 (6)	0.4 (0.4)
25b	35 (14)	3 (1)	2 (1)	30 (12)	8 (2)	0.6 (0.5)
25c	28 (11)	10 (4)	5 (2)	13 (5)	8 (2)	0.3 (0.3)
	71 (29)	13 (5)	8 (3)	50 (20)		1.3 (1.2)
26	70 (28)	12 (5)	8 (3)	50 (20)	15 (5)	1.9 (1.7)
27a	230 (93)	100 (40)	5 (2)	125 (51)	12 (4)	3.8 (3.4)
27b	130 (53)	70 (28)	30 (12)	30 (12)	20 (6)	1.5 (1.4)
	360 (146)	170 (69)	35 (14)	155 (63)		5.3 (4.8)
	500 (202)	195 (79)	51 (21)	255 (103)		8.5 (7.7)
Humphrey Geographic Township						
24a	10 (4)	0 (0)	5 (2)	5 (2)	12 (4)	0.2 (0.2)
27b[2]	12 (5)	9 (4)	3 (1)	0 (0)	20 (6)	0 (0)
27c	380 (154)	180 (73)	20 (8)	180 (73)	12 (4)	5.4 (4.9)
	390 (158)	189 (76)	23 (9)	180 (73)		5.4 (4.9)
28a	30 (12)	0 (0)	5 (2)	25 (10)	10 (3)	0.6 (0.5)
28b	120 (49)	30 (12)	40 (16)	50 (20)	12 (4)	1.5 (1.4)
	150 (61)	30 (12)	45 (18)	75 (30)		2.1 (1.9)
	550 (223)	219 (89)	73 (30)	260 (105)		7.7 (7.0)

TABLE 3. SELECTED SAND AND GRAVEL RESOURCE AREAS, PARRY SOUND TO FRENCH RIVER AREA.

1 DEPOSIT NO.	2 UNLICENCED AREA Acres (Hectares)	3 CULTURAL SETBACKS Acres (Hectares)	4 EXTRACTED AREA Acres (Hectares)	5 AVAILABLE AREA Acres (Hectares)	6 ESTIMATED DEPOSIT THICKNESS Feet (Metres)	7 AVAILABLE[1] AGGREGATE Millions of Tons (Tonnes)
TOTAL FOR PARRY SOUND MAP AREA:						
	2150 (870)	580 (235)	270 (109)	1310 (530)		45.0 (41.0)
TOTAL FOR STUDY AREA:						
	3750 (1520)	830 (335)	410 (166)	2550 (1030)		79.0 (72.0)

[1] *For practical purposes, the Original Tonnage and Available Aggregate Figures for this project area have been shown to the nearest decimal place, because of the small amounts of material present in some deposits.*

[2] *Most of Selected Resource Area 27b is located in Conger geographic township. A small portion of the Resource Area is located in Humphrey geographic township. Although none of the aggregate in this small portion is considered to be available for extraction based on cultural constraint calculations, it is shown here for completeness.*

TABLE 4. QUARRIES, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 REMARKS
BYNG INLET MAP AREA					
Key Harbour Area					
			- NONE -		
Henvey Geographic Township					
Q1	K5-19	7	3	10-20 (3-6)	migmatitic gneiss, water on floor
Q2	K5-15	3	A	10-25 (3-8)	quarry floor flooded
Mowat Geographic Township					
Q3	N14-1	19	12	10-15 (3-5)	migmatitic gneiss, quarry floor flooded
Blair Geographic Township					
Q4	N14-12	31	7	30-40 (9-12)	migmatitic gneiss
Q5	-	35	1,2	5-8 (1.5-2)	highly sheared gneiss in fault zone
Q6	N14-15	unsubdivided portion		25 (8)	migmatitic gneiss, water on quarry floor
Wallbridge Geographic Township					
			- NONE -		
Brown Geographic Township					
			- NONE -		
POINTE AU BARIL STATION MAP AREA					
Harrison Geographic Township					
Q7	P27-10	28	14	10-20 (3-6)	gneiss, water on floor
Shawanaga Geographic Township					
Q8	P27-20	19	10	10-15 (3-5)	gneiss, >10 feet (>3 m) of water on floor
Carling Geographic Township					
Q9	P5-21	7	5	10-15 (3-5)	gneiss, water on floor in one area
Q10	-	9	3	20 (6)	gneiss, overgrown
Q11	P5-58	65	9	10-15 (3-5)	meta-arkose, irregular quarry floor
Ferguson Geographic Township					
			- NONE -		

TABLE 4. QUARRIES, PARRY SOUND TO FRENCH RIVER AREA.

1 NO.	2 MTO NO.	3 LOT	4 CON.	5 FACE HEIGHT Feet (Metres)	6 REMARKS
PARRY SOUND MAP AREA					
McDougall Geographic Township					
Q12	P5-44	9	A	6 (2)	gneiss
Q13	O8-30	19	1	15-50 (5-15)	gneiss
Foley Geographic Township					
Q14	-	20	12	15-20 (5-6)	
Q15	08-19	132	B	30 (9)	
Christie Geographic Township					
			- NONE -		
Cowper Geographic Township					
			- NONE -		
Conger Geographic Township					
			- NONE -		
Humphrey Geographic Township					
			- NONE -		

TABLE 5. SUMMARY OF TEST HOLE DATA, PARRY SOUND TO FRENCH RIVER AREA.

BYNG INLET MAP AREA

Test Hole Number: PS-TH-1

Location: Mowat Geographic Township
Lot 8, Concession 15

Elevation: Approximately 750 feet (229 m) a.s.l.

Date: August 31, 1987

Depth feet (metres)	Description
0–2.9 (0–0.9)	clean medium sand
2.9–3.7 (0.9–1.1)	silty fine sand
3.7–6.5 (1.1–2.0)	silty, sandy gravel; abundant boulders; water at 6.0 feet (1.8 m)
6.5–7.7 (2.0–2.4)	wet medium to coarse sand with occasional layers of silty fine sand

Test Hole Number: PS-TH-2

Location: Mowat Geographic Township
Lot 8, Concession 15

Elevation: Approximately 750 feet (229 m) a.s.l.

Date: August 31, 1987

Depth feet (metres)	Description
0–4.0 (0–1.2)	fine gravel; minor limonite staining
4.0–11.0 (1.2–3.4)	silty fine sand; water encountered at base of hole

Test Hole Number: PS-TH-3

Location: Mowat Geographic Township
Lot 8, Concession 15

Elevation: Approximately 750 feet (229 m) a.s.l.

Date: September 1, 1987

Depth feet (metres)	Description
0–2.7 (0–0.8)	dirty fine to coarse gravel with a coarse sand matrix; abundant boulders
2.7–10.0 (0.8–3.0)	clean, gravelly sand

Test Hole Number: PS-TH-4

Location: Mowat Geographic Township
Lot 10, Concession 10

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 1, 1987

Depth feet (metres)	Description
0–2.0 (0–0.6)	dirty fine to medium sand
2.0–7.7 (0.6–2.4)	fine to medium sand with one 0.5-foot (0.2 m) thick silt seam; bedrock at base of hole

Test Hole Number: PS-TH-5

Location: Blair Geographic Township
Unsubdivided portion

Elevation: Approximately 650 feet (198 m) a.s.l.

Date: September 1, 1987

Depth feet (metres)	Description
0–1.0 (0–0.3)	medium sand
1.0–8.0 (0.3–2.4)	clay

Test Hole Number: PS-TH-6

Location: Wallbridge Geographic Township
Lot 21, Concession 4

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 2, 1987

Depth feet (metres)	Description
0–4.2 (0–1.3)	coarse sand with minor fine gravel
4.2–6.0 (1.3–1.8)	medium sand with silty fine sand interbeds
6.0–9.0 (1.8–2.7)	stony sand till; bedrock at base of hole

Test Hole Number: PS-TH-7

Location: Wallbridge Geographic Township
Lot 19, Concession 4

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 2, 1987

Depth feet (metres)	Description
0–2.0 (0–0.6)	dirty fine to medium sand
2.0–5.2 (0.6–1.6)	stony sand till; bedrock at base of hole

Test Hole Number: PS-TH-8

Location: Wallbridge Geographic Township
Lot 9, Concession 4

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 2, 1987

Depth feet (metres)	Description
0–10.0 (0–3.0)	very fine to medium sand; one 3-inch (8 cm) thick silt seam, water table encountered at 8.0 feet (2.4 m)

TABLE 5. SUMMARY OF TEST HOLE DATA, PARRY SOUND TO FRENCH RIVER AREA.

POINTE AU BARIL STATION MAP AREA

Test Hole Number: PS-TH-9

Location: Shawanaga Geographic Township
Lot 3, Concession 10

Elevation: Approximately 750 feet (229 m) a.s.l.

Date: September 3, 1987

Depth feet (metres)	Description
0-2.2 (0-0.7)	dirty medium sand; medium to coarse gravel lag at base of unit
2.2-8.3 (0.7-2.5)	clean medium sand
8.3-9.3 (2.5-2.8)	inclined seam of medium to coarse gravel over medium to coarse sand with rare fine gravel

Test Hole Number: PS-TH-10

Location: Shawanaga Geographic Township
Lot 4, Concession 10

Elevation: Approximately 750 feet (229 m) a.s.l.

Date: September 3, 1987

Depth feet (metres)	Description
0-2.0 (0-0.6)	dirty medium sand
2.0-7.5 (0.6-2.3)	clean medium sand; water table encountered at 6.4 feet (2.0 m)
7.5-8.0 (2.3-2.4)	clean gravelly coarse sand

Test Hole Number: PS-TH-11

Location: Shawanaga Geographic Township
Lot 4, Concession 10

Elevation: Approximately 750 feet (229 m) a.s.l.

Date: September 3, 1987

Depth feet (metres)	Description
0-2.0 (0-0.6)	dirty medium sand with rare pebbles
2.0-2.8 (0.6-0.8)	fine gravel
2.8-9.0 (0.8-2.7)	clean medium sand; water encountered at base of hole

Test Hole Number: PS-TH-12

Location: Shawanaga Geographic Township
Lot 11, Concession 10

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 2, 1987

Depth feet (metres)	Description
0-2.3 (0-0.7)	dirty medium sand
2.3-3.7 (0.7-1.1)	gravelly medium sand
3.7-5.0 (1.1-1.5)	silt
5.0-6.1 (1.5-1.9)	fine sand
6.1-8.5 (1.9-2.6)	stony sand till
8.5-9.0 (2.6-2.7)	silty fine to medium sand; water encountered at base of hole

Test Hole Number: PS-TH-13

Location: Shawanaga Geographic Township
Lot 12, Concession 10

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 2, 1987

Depth feet (metres)	Description
0-4.2 (0-1.3)	clean medium sand; bedrock at base of hole

Test Hole Number: PS-TH-14

Location: Shawanaga Geographic Township
Lot 12, Concession 8
(base of pit no. 95)

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 3, 1987

Depth feet (metres)	Description
0-7.5 (0-2.3)	clean medium sand; water table encountered at 5.0 feet (1.5 m); bedrock at base of hole

Test Hole Number: PS-TH-15

Location: Shawanaga Geographic Township
Lot 13, Concession 8

Elevation: Approximately 700 feet (213) a.s.l.

Date: September 3, 1987

Depth feet (metres)	Description
0-4.6 (0-1.4)	medium to coarse sand; bedrock at base of hole

Test Hole Number: PS-TH-16

Location: Shawanaga Geographic Township
Lot 13, Concession 8

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 3, 1987

Depth feet (metres)	Description
0-2.0 (0-0.6)	dirty fine to medium sand
2.0-7.7 (0.6-2.4)	fine to medium sand
7.7-8.3 (2.4-2.5)	stony sand till; bedrock at base of hole

TABLE 5. SUMMARY OF TEST HOLE DATA, PARRY SOUND TO FRENCH RIVER AREA.

Test Hole Number: PS-TH-17

Location: Shawanaga Geographic Township
Lot 5, Concession 6

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 4, 1987

Depth feet (metres)	Description
0-1.6 (0-0.5)	dirty medium sand
1.6-3.2 (0.5-1.0)	clean medium sand
3.2-9.6 (1.0-2.9)	clean gravelly coarse sand

Test Hole Number: PS-TH-18

Location: Shawanaga Geographic Township
Lot 5, Concession 5

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 4, 1987

Depth feet (metres)	Description
0-2.0 (0-0.6)	dirty medium to coarse sand
2.0-9.0 (0.6-2.7)	clean medium sand
9.0-9.4 (2.7-2.9)	moist medium sand

Test Hole Number: PS-TH-19

Location: Shawanaga Geographic Township
Lot 6, Concession 6

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 4, 1987

Depth feet (metres)	Description
0-1.5 (0-0.5)	dirty medium sand
1.5-2.7 (0.5-0.8)	clean medium sand with rare fine gravel
2.7-4.0 (0.8-1.2)	medium to coarse sand with some fine gravel
4.0-4.7 (1.2-1.4)	medium sand
4.7-8.0 (1.4-2.4)	medium to coarse sand with minor fine gravel; bedrock at base of hole

Test Hole Number: PS-TH-20

Location: Shawanaga Geographic Township
Lot 6, Concession 5

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 4, 1987

Depth feet (metres)	Description
0-2.0 (0-0.6)	dirty medium sand
2.0-9.8 (0.6-3.0)	dry, clean medium sand

Test Hole Number: PS-TH-21

Location: Shawanaga Geographic Township
Lot 6, Concession 5

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 4, 1987

Depth feet (metres)	Description
0-1.8 (0-0.5)	dirty medium sand
1.8-6.8 (0.5-2.1)	fine to medium sand
6.8-8.6 (2.1-2.6)	sandy coarse gravel; bedrock or large boulder encountered at base of hole

Test Hole Number: PS-TH-22

Location: Shawanaga Geographic Township
Lot 5, Concession 5

Elevation: Approximately 700 feet (213 m) a.s.l.

Date: September 4, 1987

Depth feet (metres)	Description
0-1.8 (0-0.5)	dirty medium sand
1.8-3.5 (0.5-1.1)	clean medium sand
3.5-5.3 (1.1-1.6)	slightly silty fine to medium sand
5.3-6.5 (1.6-2.0)	stony silty sand till; bedrock at base of hole

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

BYNG INLET MAP AREA

Line Number: PS-GT-1

Line Direction: East-West

Method: Hammer Seismic

Location: Mowat Geographic Township
Lot 7, Concession 15

Elevation: Approximately 750 ft (229 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1330 ft/sec (405 m/sec)
V_2 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 26 ft (7.9 m)

Interpretation: Approximately 26 feet (7.9 m) of sand and gravel over bedrock.

Line Number: PS-GT-2

Line Direction: North-South

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 29, Concession 2

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1790 ft/sec (550 m/sec)
V_2 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 16 ft (4.9 m)

Interpretation: Approximately 16 feet (4.9 m) of sand over bedrock.

Line Number: PS-GT-3

Line Direction: North-northeast-South-southwest

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 29, Concession 2

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1370 ft/sec (420 m/sec)
V_2 = 6200 ft/sec (1890 m/sec)
V_3 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 7 ft (2.1 m)
D_2 = 22 ft (6.7 m)

Interpretation: Approximately 7 feet (2.1 m) of sand over 22 feet (6.7 m) of wet sand underlain by bedrock.

Line Number: PS-GT-4

Line Direction: East-West

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 29, Concession 2

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1620 ft/sec (495 m/sec)
V_2 = 5300 ft/sec (1620 m/sec)
V_3 = 25,000 ft/sec (7600 m/sec)
Layer Thickness: D_1 = 12 ft (3.7 m)
D_2 = 22 ft (6.7 m)

Interpretation: Approximately 12 feet (3.7 m) of sand over 22 feet (6.7 m) of wet sand underlain by bedrock.

Line Number: PS-GT-5

Line Direction: North-South

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 28, Concession 2

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1370 ft/sec (420 m/sec)
V_2 = 33,500 ft/sec (10 200 m/sec)
Layer Thickness: D_1 = 10 ft (3.0 m)

Interpretation: Approximately 10 feet (3.0 m) of sand over bedrock.

Line Number: PS-GT-6

Line Direction: East-West

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 27, Concession 2

Elevation: Approximately 700 ft (213) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1410 ft/sec (430 m/sec)
V_2 = 4750 ft/sec (1450 m/sec)
V_3 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 6 ft (1.8 m)
D_2 = 16 ft (4.9 m)

Interpretation: Approximately 6 feet (1.8 m) of sand over 16 feet (4.9 m) of wet sand and gravel underlain by bedrock.

Line Number: PS-GT-7

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 9, Concession 3

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 2040 ft/sec (620 m/sec)
V_2 = 4750 ft/sec (1450 m/sec)
V_3 = 67,000 ft/sec (20 400 m/sec)
Layer Thickness: D_1 = 6 ft (1.8 m)
D_2 = 15 ft (4.6 m)

Interpretation: Approximately 6 feet (1.8 m) of sand over 15 feet (4.6 m) of wet sand underlain by bedrock.

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

Line Number: PS-GT-8

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 8, Concession 3

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1180 ft/sec (360 m/sec)
V_2 = 3700 ft/sec (1130 m/sec)
V_3 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 4 ft (1.2 m)
D_2 = 10 ft (3.0 m)

Interpretation: Approximately 4 feet (1.2 m) of sand and gravel over 10 feet (3.0 m) of moist sand and gravel underlain by an irregular bedrock surface.

Line Number: PS-GT-9

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Wallbridge Geographic Township
Lot 8, Concession 3

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1430 ft/sec (435 m/sec)
V_2 = 5600 ft/sec (1710 m/sec)
V_3 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 8 ft (2.4 m)
D_2 = 7 ft (2.1 m)

Interpretation: Approximately 8 feet (2.4 m) of sand and gravel over 7 feet (2.1 m) of wet sand and gravel underlain by bedrock.

POINTE AU BARIL STATION MAP AREA

Line Number: PS-GT-10

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 10, Concession 10

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1470 ft/sec (450 m/sec)
V_2 = 14,300 ft/sec (4350 m/sec)
Layer Thickness: D_1 = 7 ft (2.1 m)

Interpretation: Approximately 7 feet (2.1 m) of sand over bedrock.

Line Number: PS-GT-11

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 8, Concession 9

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1450 ft/sec (440 m/sec)
V_2 = 11,100 ft/sec (3400 m/sec)
Layer Thickness: D_1 = 11 ft (3.4 m)

Interpretation: Approximately 11 feet (3.4 m) of sand over bedrock.

Line Number: PS-GT-12

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 9, Concession 9

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1430 ft/sec (435 m/sec)
V_2 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 14 ft (4.3 m)

Interpretation: Approximately 14 feet (4.3 m) of sand over bedrock.

Line Number: PS-GT-13

Line Direction: North-northeast-South-southwest

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 9, Concession 9

Elevation: Approximately 750 ft (229 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1270 ft/sec (385 m/sec)
V_2 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 18 ft (5.5 m)

Interpretation: Approximately 18 feet (5.5 m) of sand underlain by bedrock.

Line Number: PS-GT-14

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 10, Concession 8

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1250 ft/sec (380 m/sec)
V_2 = 2270 ft/sec (690 m/sec)
V_3 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 2 ft (0.6 m)
D_2 = 40 ft (12.2 m)

Interpretation: Approximately 42 feet (12.8 m) of sand becoming denser with depth, underlain by bedrock.

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

Line Number: PS-GT-15

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 11, Concession 9

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1190 ft/sec (365 m/sec)
V_2 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 16 ft (4.9 m)

Interpretation: Approximately 16 feet (4.9 m) of sand over an irregular bedrock surface.

Line Number: PS-GT-16

Line Direction: East-West

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 16, Concession 9

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1250 ft/sec (380 m/sec)
V_2 = 3700 ft/sec (1130 m/sec)
V_3 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 4 ft (1.2 m)
D_2 = 20 ft (6.1 m)

Interpretation: Approximately 4 feet (1.2 m) of sand over 20 feet (6.1 m) of moist sand underlain by bedrock.

Line Number: PS-GT-17

Line Direction: North-northwest-South-southeast

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 9, Concession 6

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1430 ft/sec (435 m/sec)
V_2 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 14 ft (4.3 m)

Interpretation: Approximately 14 feet (4.3 m) of sand over an irregular bedrock surface.

Line Number: PS-GT-18

Line Direction: East-West

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 10, Concession 6

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1270 ft/sec (385 m/sec)
V_2 = 2220 ft/sec (680 m/sec)
V_3 = 11,100 ft/sec (3400 m/sec)
Layer Thickness: D_1 = 5 ft (1.5 m)
D_2 = 17 ft (5.2 m)

Interpretation: Approximately 5 feet (1.5 m) of sand over 17 feet (5.2 m) of dense or moist sand underlain by bedrock.

Line Number: PS-GT-19

Line Direction: North-South

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 9, Concession 6

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1280 ft/sec (390 m/sec)
V_2 = 6300 ft/sec (1920 m/sec)
V_3 = 33,500 ft/sec (10 200 m/sec)
Layer Thickness: D_1 = 9 ft (2.7 m)
D_2 = 21 ft (6.4 m)

Interpretation: Approximately 9 ft (2.7 m) of sand over 21 feet (6.4 m) of wet sand underlain by bedrock.

Line Number: PS-GT-20

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: Shawanaga Geographic Township
Lot 9, Concession 6

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1330 ft/sec (405 m/sec)
V_2 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 14 ft (4.3 m)

Interpretation: Approximately 14 feet (4.3 m) of sand over bedrock.

Line Number: PS-GT-21

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: Carling Geographic Township
Lot 15, Concession 8

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1280 ft/sec (390 m/sec)
V_2 = 4150 ft/sec (1260 m/sec)
V_3 = 8300 ft/sec (2550 m/sec)
Layer Thickness: D_1 = 4 ft (1.2 m)
D_2 = 9 ft (2.7 m)

Interpretation: Approximately 4 feet (1.2 m) of sand over 9 feet (2.7 m) of wet sand and silt over bedrock.

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

Line Number: PS-GT-22

Line Direction: North-South

Method: Hammer Seismic

Location: Ferguson Geographic Township
Lot 17, Concession 1

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1410 ft/sec (430 m/sec)
V_2 = 14,300 ft/sec (4350 m/sec)
Layer Thickness: D_1 = 11 ft (3.4 m)

Interpretation: Approximately 11 feet (3.4 m) of sand over an irregular bedrock surface.

PARRY SOUND MAP AREA

Line Number: PS-GT-23

Line Direction: North-South

Method: Hammer Seismic

Location: McDougall Geographic Township
Lot 16, Concession 12

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1020 ft/sec (310 m/sec)
V_2 = 2550 ft/sec (780 m/sec)
V_3 = 9100 ft/sec (2750 m/sec)
Layer Thickness: D_1 = 3 ft (0.9 m)
D_2 = 10 ft (3.0 m)

Interpretation: Approximately 13 feet (4.0 m) of sand becoming denser with depth, underlain by bedrock.

Line Number: PS-GT-24

Line Direction: North-South

Method: Hammer Seismic

Location: McDougall Geographic Township
Lot 16, Concession 12

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1270 ft/sec (385 m/sec)
V_2 = 3700 ft/sec (1130 m/sec)
V_3 = 33,500 ft/sec (10 200 m/sec)
Layer Thickness: D_1 = 7 ft (2.1 m)
D_2 = 16 ft (4.9 m)

Interpretation: Approximately 7 feet (2.1 m) of loose sand underlain by 16 feet (4.9 m) of dense or moist sand over bedrock.

Line Number: PS-GT-25

Line Direction: North-South

Method: Hammer Seismic

Location: McDougall Geographic Township
Lot 19, Concession 6

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1370 ft/sec (420 m/sec)
V_2 = 11,100 ft/sec (3400 m/sec)
Layer Thickness: D_1 = 37 ft (11.3 m)

Interpretation: Approximately 37 feet (11.3 m) of sand over bedrock.

Line Number: PS-GT-26

Line Direction: North-South

Method: Hammer Seismic

Location: McDougall Geographic Township
Lot 13, Concession 4

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1430 ft/sec (435 m/sec)
V_2 = 5000 ft/sec (1520 m/sec)
Layer Thickness: D_1 = 8 ft (2.4 m)

Interpretation: Approximately 8 feet (2.4 m) of sand and gravel underlain by wet sand and gravel to a minimum depth of 40 feet (12.2 m).

Line Number: PS-GT-27

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: McDougall Geographic Township
Lot 13, Concession 4

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1470 ft/sec (450 m/sec)
V_2 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 29 ft (8.8 m)

Interpretation: Approximately 29 feet (8.8 m) of sand and gravel underlain by bedrock.

Line Number: PS-GT-28

Line Direction: North-South

Method: Hammer Seismic

Location: McDougall Geographic Township
Lot 13, Concession 4

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1330 ft/sec (405 m/sec)
V_2 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 35 ft (10.7 m)

Interpretation: Approximately 35 feet (10.7 m) of sand and gravel underlain by bedrock.

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

Line Number: PS-GT-29

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Foley Geographic Township
Lot 19, Concession 5

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1470 ft/sec (450 m/sec)
V_2 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 10 ft (3.0 m)

Interpretation: Approximately 10 feet (3.0 m) of sand underlain by bedrock.

Line Number: PS-GT-30

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Foley Geographic Township
Lot 31, Concession 3

Elevation: Approximately 750 ft (229 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1180 ft/sec (360 m/sec)
V_2 = 2000 ft/sec (610 m/sec)
V_3 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 4 ft (1.2 m)
D_2 = 26 ft (7.9 m)

Interpretation: Approximately 30 feet (9.1 m) of sand underlain by bedrock.

Line Number: PS-GT-31

Line Direction: North-South

Method: Hammer Seismic

Location: Foley Geographic Township
Lot 30, Concession 2

Elevation: Approximately 750 ft (229 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1300 ft/sec (395 m/sec)
V_2 = 5600 ft/sec (1710 m/sec)
Layer Thickness: D_1 = 10 ft (3.0 m)

Interpretation: Approximately 10 feet (3.0 m) of sand underlain by wet sand to a minimum depth of 40 feet (12.2 m).

Line Number: PS-GT-32

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Christie Geographic Township
Lot 19, Concession 13

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1540 ft/sec (470 m/sec)
V_2 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 9 ft (2.7 m)

Interpretation: Approximately 9 feet (2.7 m) of sand underlain by bedrock.

Line Number: PS-GT-33

Line Direction: East-northeast-West-southwest

Method: Hammer Seismic

Location: Christie Geographic Township
Lot 10, Concession 10

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1320 ft/sec (400 m/sec)
V_2 = 3550 ft/sec (1080 m/sec)
Layer Thickness: D_1 = 8 ft (2.4 m)

Interpretation: Approximately 8 feet (2.4 m) of sand underlain by denser sand or till to a minimum depth of 40 feet (12.2 m).

Line Number: PS-GT-34

Line Direction: East-West

Method: Hammer Seismic

Location: Christie Geographic Township
Lot 18, Concession 1

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1640 ft/sec (500 m/sec)
V_2 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 23 ft (7.0 m)

Interpretation: Approximately 23 feet (7.0 m) of sand underlain by bedrock.

Line Number: PS-GT-35

Line Direction: East-West

Method: Hammer Seismic

Location: Christie Geographic Township
Lot 27, Concession 1

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 2040 ft/sec (620 m/sec)
V_2 = 11,100 ft/sec (3400 m/sec)
Layer Thickness: D_1 = 17 ft (5.2 m)

Interpretation: Approximately 17 feet (5.2 m) of sand underlain by bedrock.

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

Line Number: PS-GT-36

Line Direction: North-northeast-South-southwest

Method: Hammer Seismic

Location: Christie Geographic Township
Lot 27, Concession 1

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 2000 ft/sec (610 m/sec)
V_2 = 11,100 ft/sec (3400 m/sec)
Layer Thickness: D_1 = 37 ft (11.3 m)

Interpretation: Approximately 37 feet (11.3 m) of sand underlain by bedrock.

Line Number: PS-GT-37

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: Conger Geographic Township
Lot 26, Concession 8

Elevation: Approximately 750 ft (229 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1320 ft/sec (400 m/sec)
V_2 = 14,300 ft/sec (4350 m/sec)
Layer Thickness: D_1 = 10 ft (3.0 m)

Interpretation: Approximately 10 feet (3.0 m) of sand underlain by bedrock.

Line Number: PS-GT-38

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Conger Geographic Township
Lot 22, Concession 7

Elevation: Approximately 700 ft (213 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1520 ft/sec (465 m/sec)
V_2 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 27 ft (8.2 m)

Interpretation: Approximately 27 feet (8.2 m) of sand and gravel underlain by bedrock.

Line Number: PS-GT-39

Line Direction: North-South

Method: Hammer Seismic

Location: Conger Geographic Township
Lot 2, Concession 7

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1490 ft/sec (455 m/sec)
V_2 = 6700 ft/sec (2040 m/sec)
Layer Thickness: D_1 = 7 ft (2.1 m)

Interpretation: Approximately 7 feet (2.1 m) of sand underlain by bedrock.

Line Number: PS-GT-40

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Conger Geographic Township
Lot 2, Concession 7

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1390 ft/sec (425 m/sec)
V_2 = 2220 ft/sec (680 m/sec)
V_3 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 4 ft (1.2 m)
D_2 = 30 ft (9.1 m)

Interpretation: Approximately 4 feet (1.2 m) of loose sand underlain by 30 feet (9.1 m) of denser sand over bedrock.

Line Number: PS-GT-41

Line Direction: East-northeast-West-southwest

Method: Hammer Seismic

Location: Conger Geographic Township
Lot 2, Concession 8

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1470 ft/sec (450 m/sec)
V_2 = 14,300 ft/sec (4350 m/sec)
Layer Thickness: D_1 = 32 ft (9.8 m)

Interpretation: Approximately 32 feet (9.8 m) of sand underlain by bedrock.

Line Number: PS-GT-42

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: Conger Geographic Township
Lot 2, Concession 9

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1100 ft/sec (335 m/sec)
V_2 = 2700 ft/sec (820 m/sec)
V_3 = 12,500 ft/sec (3800 m/sec)
Layer Thickness: D_1 = 8 ft (2.4 m)
D_2 = 19 ft (5.8 m)

Interpretation: Approximately 8 feet (2.4 m) of sand underlain by 19 feet (5.8 m) of denser sand over bedrock.

TABLE 6. SUMMARY OF GEOPHYSICS DATA, PARRY SOUND TO FRENCH RIVER AREA.

Line Number: PS-GT-43

Line Direction: Northeast-Southwest

Method: Hammer Seismic

Location: Humphrey Geographic Township
Lot 33, Concession 12

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1370 ft/sec (420 m/sec)
V_2 = 16,700 ft/sec (5100 m/sec)
Layer Thickness: D_1 = 22 ft (6.7 m)

Interpretation: Approximately 22 feet (6.7 m) of sand over bedrock.

Line Number: PS-GT-44

Line Direction: North-South

Method: Hammer Seismic

Location: Humphrey Geographic Township
Lot 32, Concession 12

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1430 ft/sec (435 m/sec)
V_2 = 3050 ft/sec (930 m/sec)
V_3 = 16,700 ft/sec (5100 m/sec)
Layer Thickness: D_1 = 9 ft (2.7 m)
D_2 = 30 ft (9.1 m)

Interpretation: Approximately 9 feet (2.7 m) of sand underlain by 30 feet (9.1 m) of denser sand over bedrock.

Line Number: PS-GT-45

Line Direction: East-West

Method: Hammer Seismic

Location: Humphrey Geographic Township
Lot 32, Concession 12

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1220 ft/sec (370 m/sec)
V_2 = 2080 ft/sec (630 m/sec)
V_3 = 20,000 ft/sec (6100 m/sec)
Layer Thickness: D_1 = 6 ft (1.8 m)
D_2 = 19 ft (5.8 m)

Interpretation: Approximately 6 feet (1.8 m) of sand underlain by 19 feet (5.8 m) of denser sand over bedrock.

Line Number: PS-GT-46

Line Direction: North-South

Method: Hammer Seismic

Location: Humphrey Geographic Township
Lot 25, Concession 10

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 2
Layer Velocities: V_1 = 1250 ft/sec (380 m/sec)
V_2 = 10,000 ft/sec (3050 m/sec)
Layer Thickness: D_1 = 10 ft (3.0 m)

Interpretation: Approximately 10 feet (3.0 m) of sand underlain by bedrock.

Line Number: PS-GT-47

Line Direction: East-West

Method: Hammer Seismic

Location: Humphrey Geographic Township
Lot 8, Concession 10

Elevation: Approximately 850 ft (260 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1370 ft/sec (420 m/sec)
V_2 = 3700 ft/sec (1130 m/sec)
V_3 = 33,500 ft/sec (10 200 m/sec)
Layer Thickness: D_1 = 5 ft (1.5 m)
D_2 = 21 ft (6.4 m)

Interpretation: Approximately 5 feet (1.5 m) of sand underlain by 21 feet (6.4 m) of denser sand over bedrock.

Line Number: PS-GT-48

Line Direction: Northwest-Southeast

Method: Hammer Seismic

Location: Humphrey Geographic Township
Lot 7, Concession 6

Elevation: Approximately 800 ft (245 m) a.s.l.

Seismic Data:
Number of Layers: 3
Layer Velocities: V_1 = 1470 ft/sec (450 m/sec)
V_2 = 2800 ft/sec (850 m/sec)
V_3 = 9100 ft/sec (2750 m/sec)
Layer Thickness: D_1 = 6 ft (1.8 m)
D_2 = 20 ft (6.1 m)

Interpretation: Approximately 6 feet (1.8 m) of sand underlain by 20 feet (6.1 m) of sand and silt over bedrock.

TABLE 7. RESULTS OF AGGREGATE QUALITY TESTS, PARRY SOUND TO FRENCH RIVER AREA.

	COARSE AGGREGATE					FINE AGGREGATE
	Petographic Number					
Sample No.	GBC & 16 mm Crushed	Hot Mix & Concrete	Magnesium Sulphate Soundness (% Loss)	Absorption (%)	Los Angeles Abrasion and Impact (% Loss)	Magnesium Sulphate Soundness (% Loss)
Byng Inlet Map Area						
Pit 10	102	107	1	-	-	3
Pit 14	-	-	-	-	-	4
Pit 38	100	111	1	0.57	-	-
Pit 47	103	117	2	0.54	-	-
Pit 63	100	112	-	-	-	6
Pit 65	104	124	4	0.57	26	-
PS-TH-1	-	-	-	-	-	7
PS-TH-2a	-	-	9	0.50	-	4
PS-TH-3a	101	105	2	-	-	-
PS-TH-3b	100	103	7	-	-	5
PS-TH-4	-	-	-	0.58	-	-
Pointe Au Baril Station Map Area						
Pit 79	105	128	14	-	-	14
Pit 91	106	129	1	0.50	-	7
Pit 100	108	130	-	-	-	-
Pit 101	105	148	-	-	-	6
Pit 143	108	151	4	0.50	-	16
PS-TH-9b	-	-	-	-	-	5
PS-TH-10b	104	120	-	-	-	-
PS-TH-17b	-	-	-	-	-	6
PS-TH-19	-	-	-	-	-	12
Parry Sound Map Area						
Pit 165	-	-	-	-	-	9
Pit 192	102	122	-	-	-	10
Pit 198	107	145	8	-	-	12
Pit 207b	105	139	8	0.43	28	18
Pit 233	103	118	5	0.60	-	-
Pit 257a	115	176	6	-	-	-
Pit 270b	-	-	-	-	-	9
Pit 273a	102	156	4	0.80	-	6
Pit 298	107	143	4	0.50	-	21
Pit 303b	104	135	9	0.47	-	-
Pit 321b	105	126	6	0.47	-	10
Pit 362	117	136	2	-	-	8

NOTE: The results of the quality tests refer strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit. See Appendix D for descriptions of the tests and quality requirements for major aggregate products.

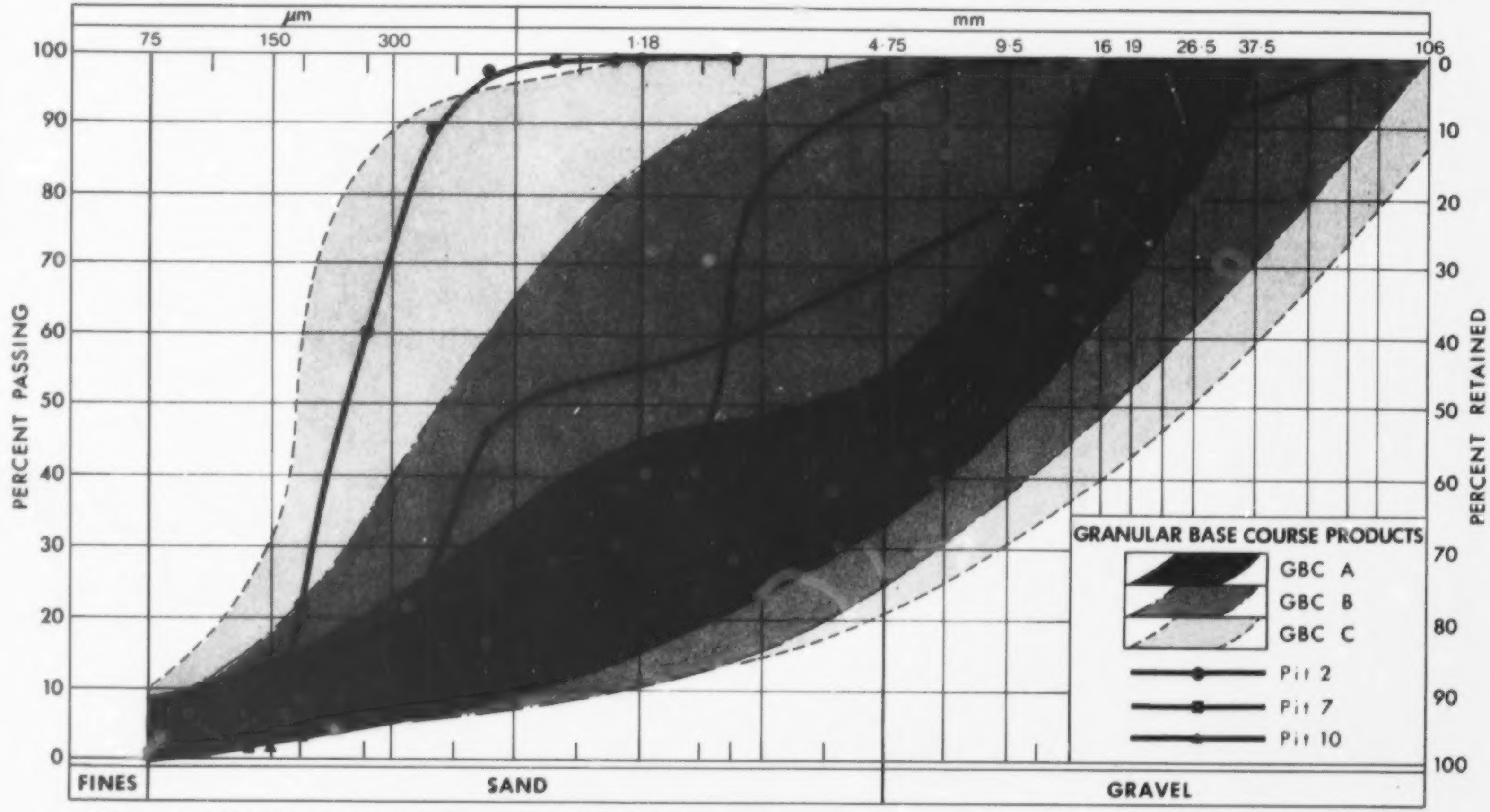


FIGURE 4a: AGGREGATE GRADING CURVES, BYNG INLET MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

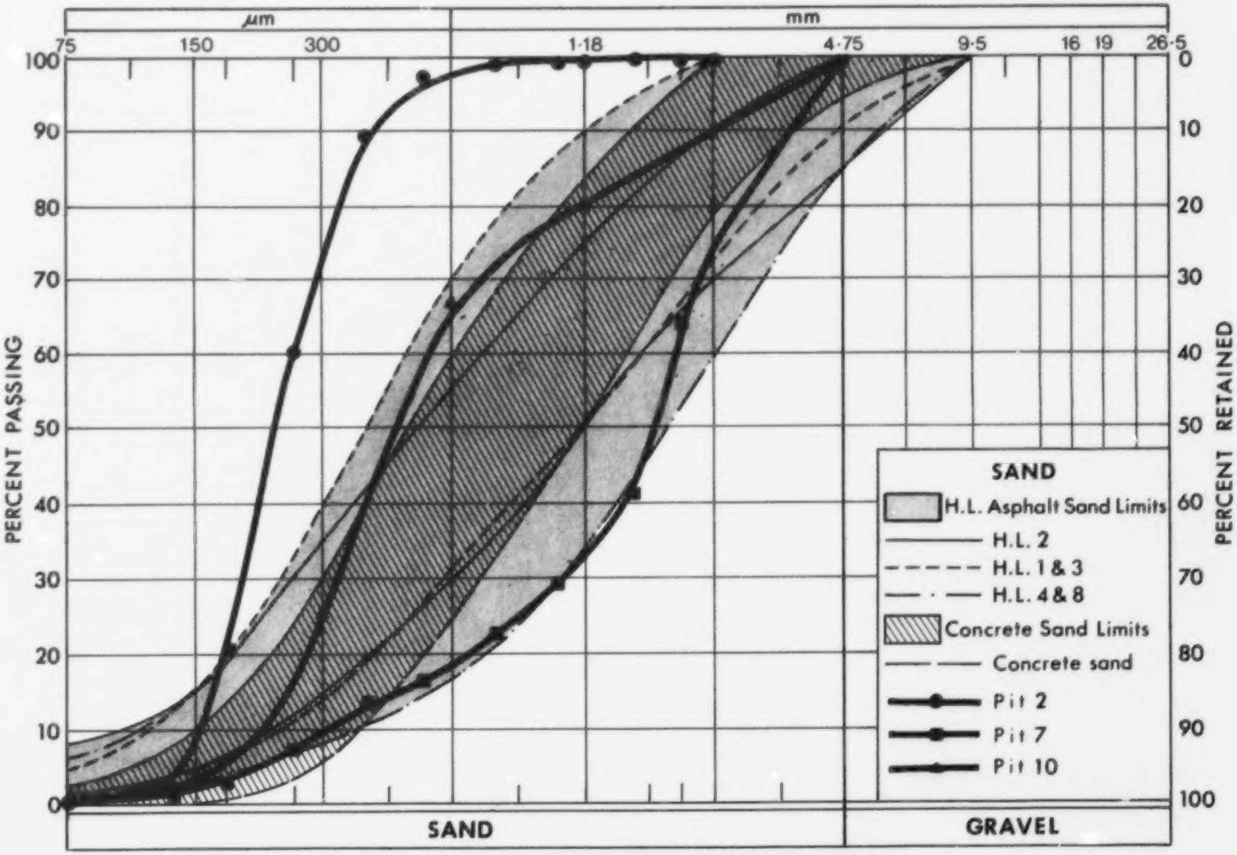


FIGURE 4b: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

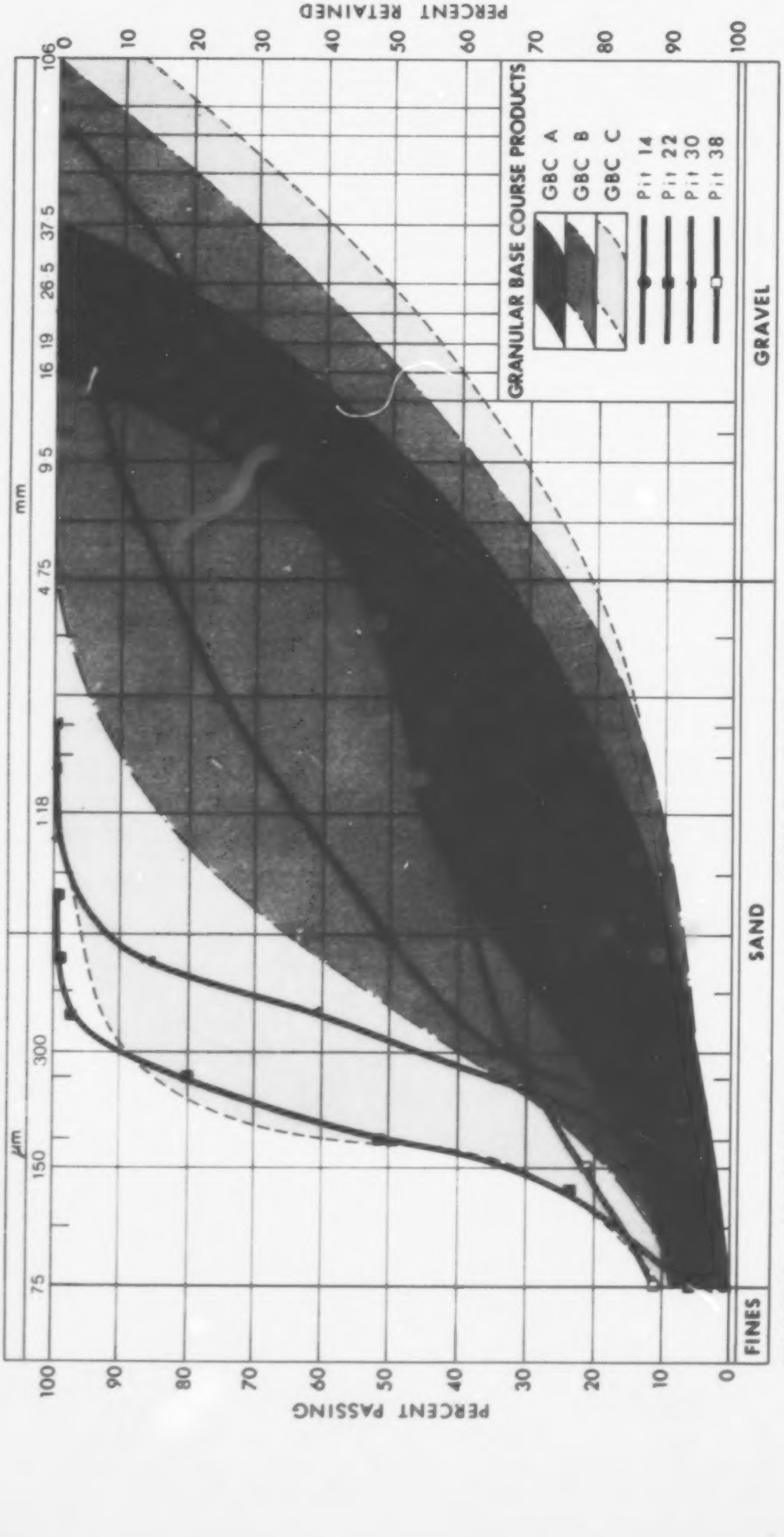


FIGURE 5a: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA:**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from [illegible].T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

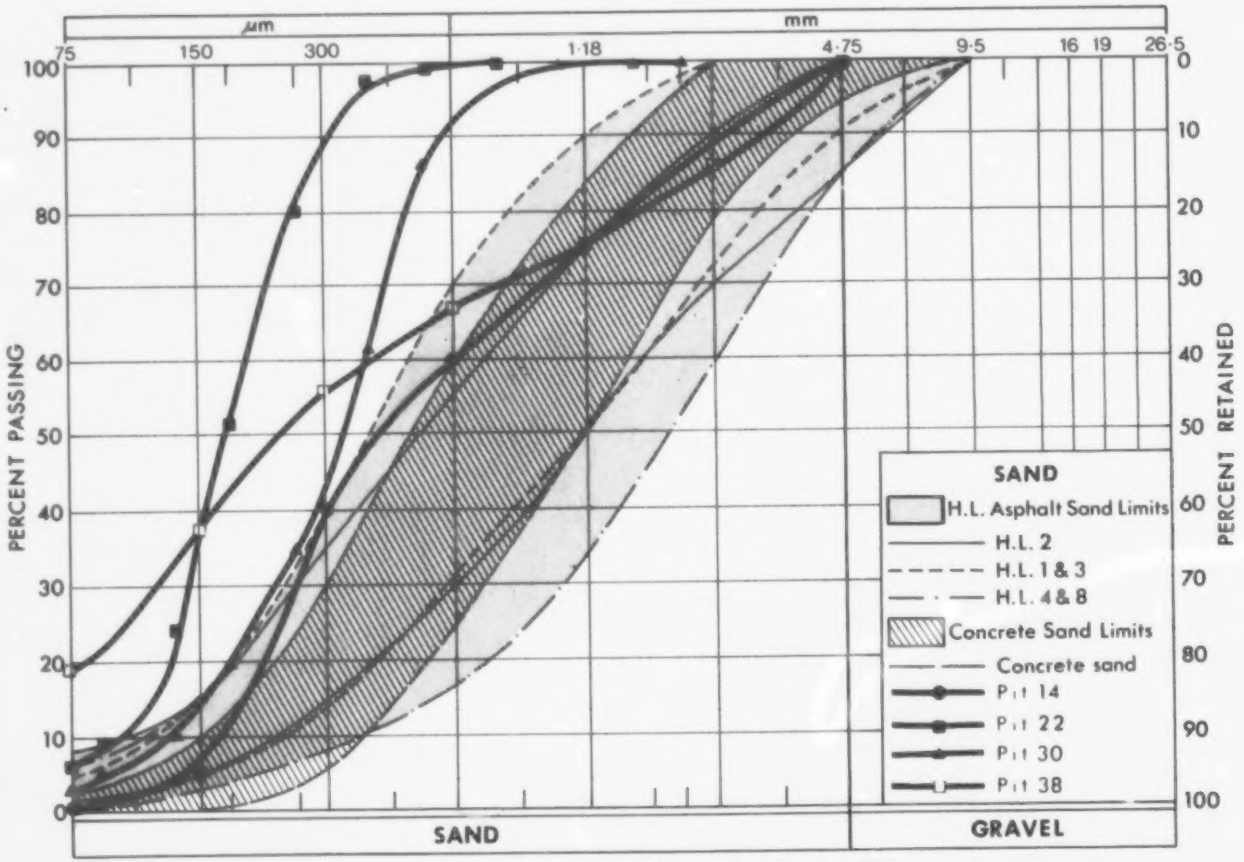


FIGURE 5b AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA**;

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

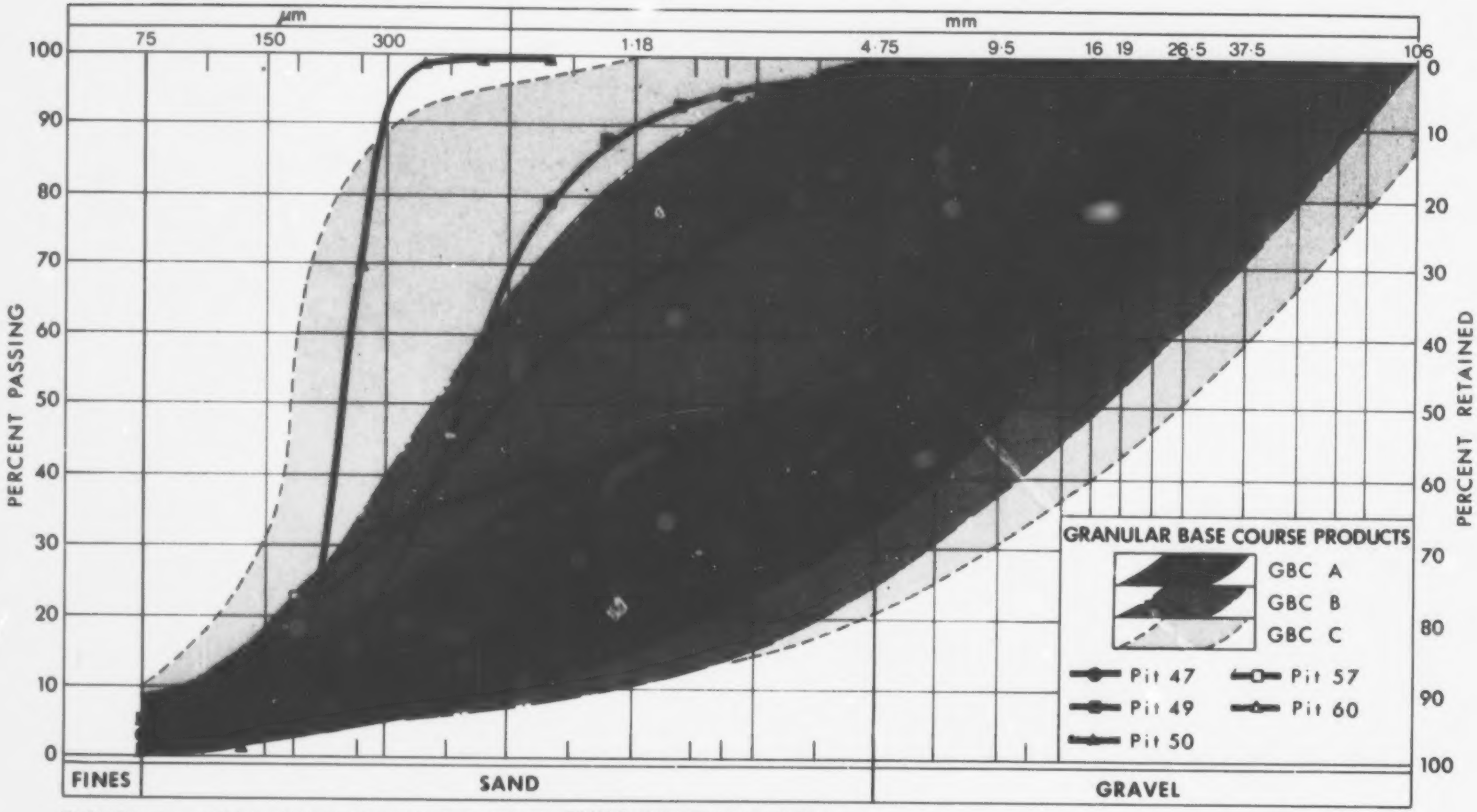


FIGURE 6a: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

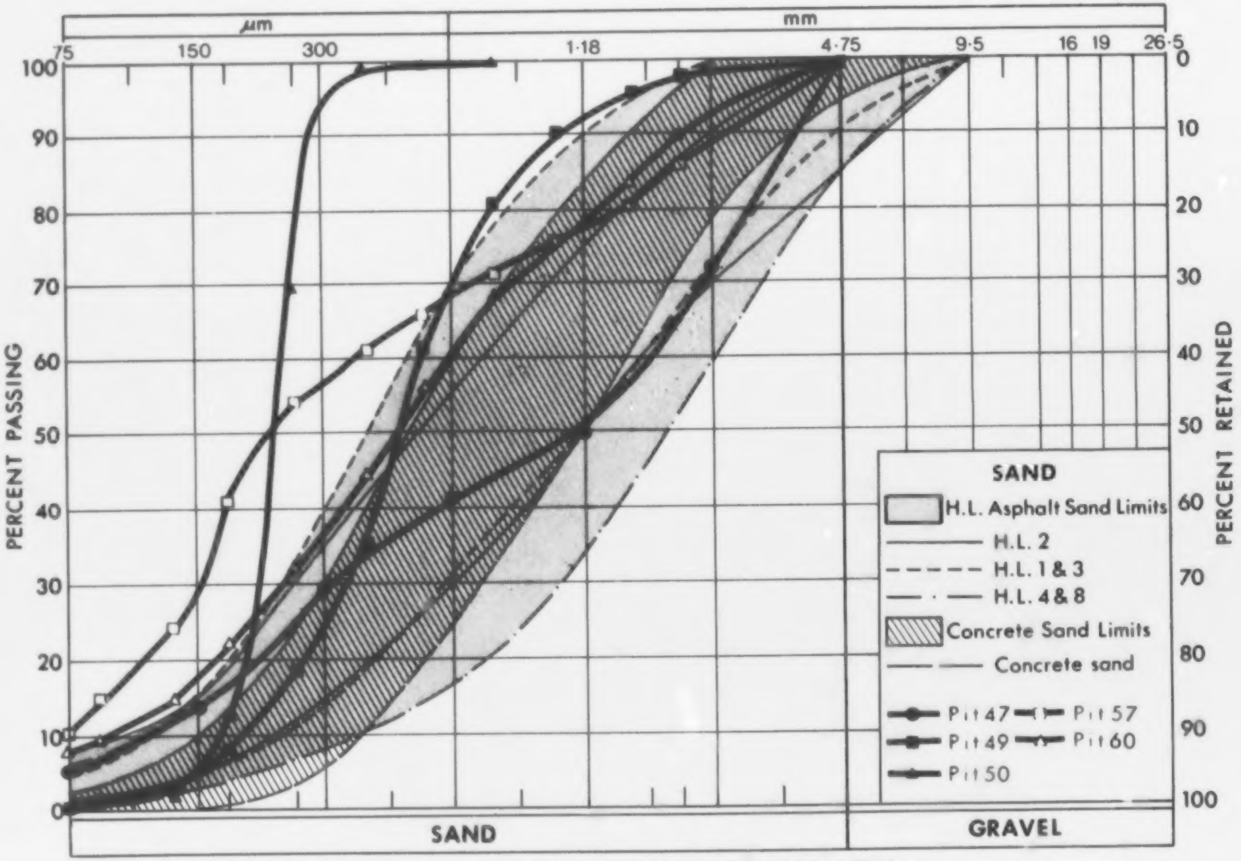


FIGURE 6b AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA**;

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

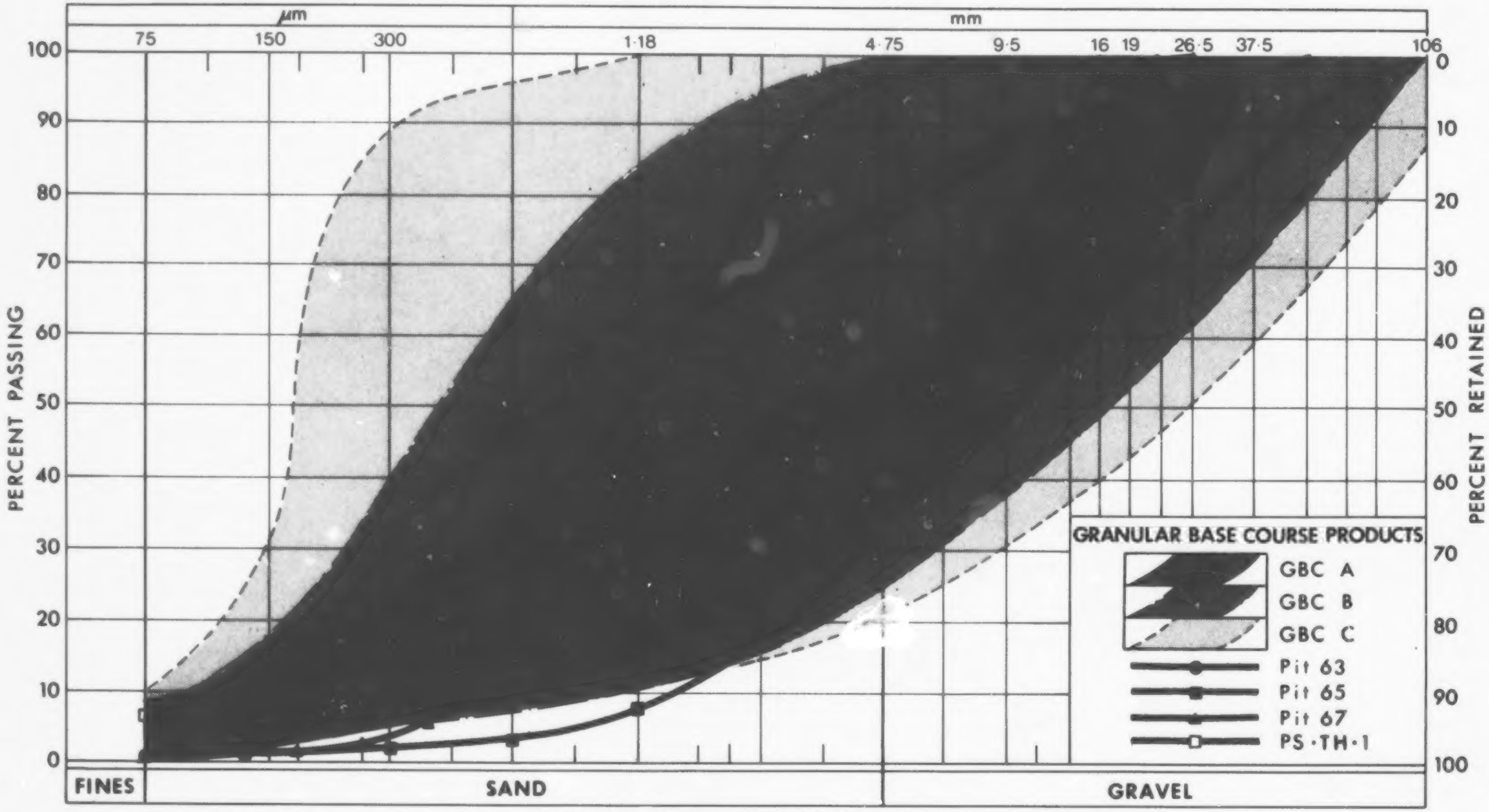


FIGURE 7a: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

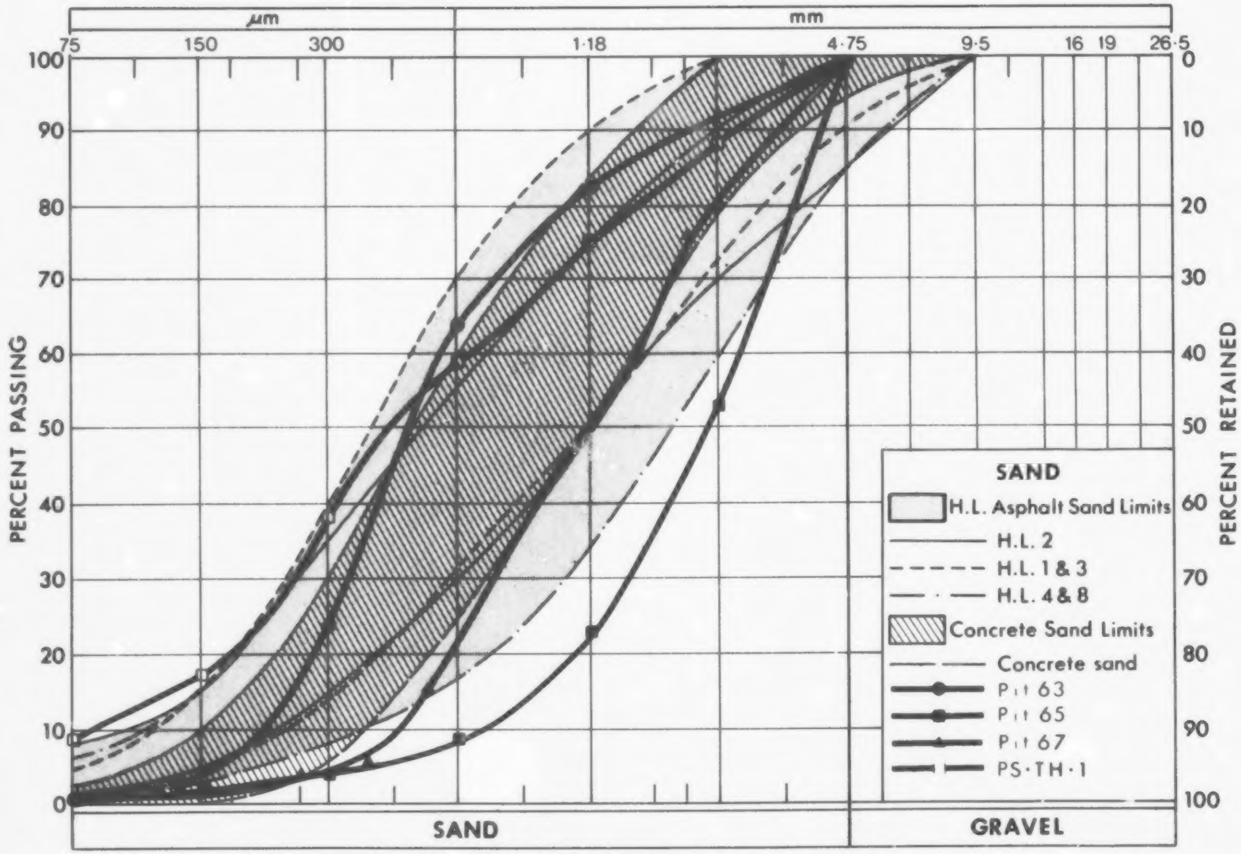


FIGURE 7b AGGREGATE GRADING CURVES, BYNG INLET MAP AREA;

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

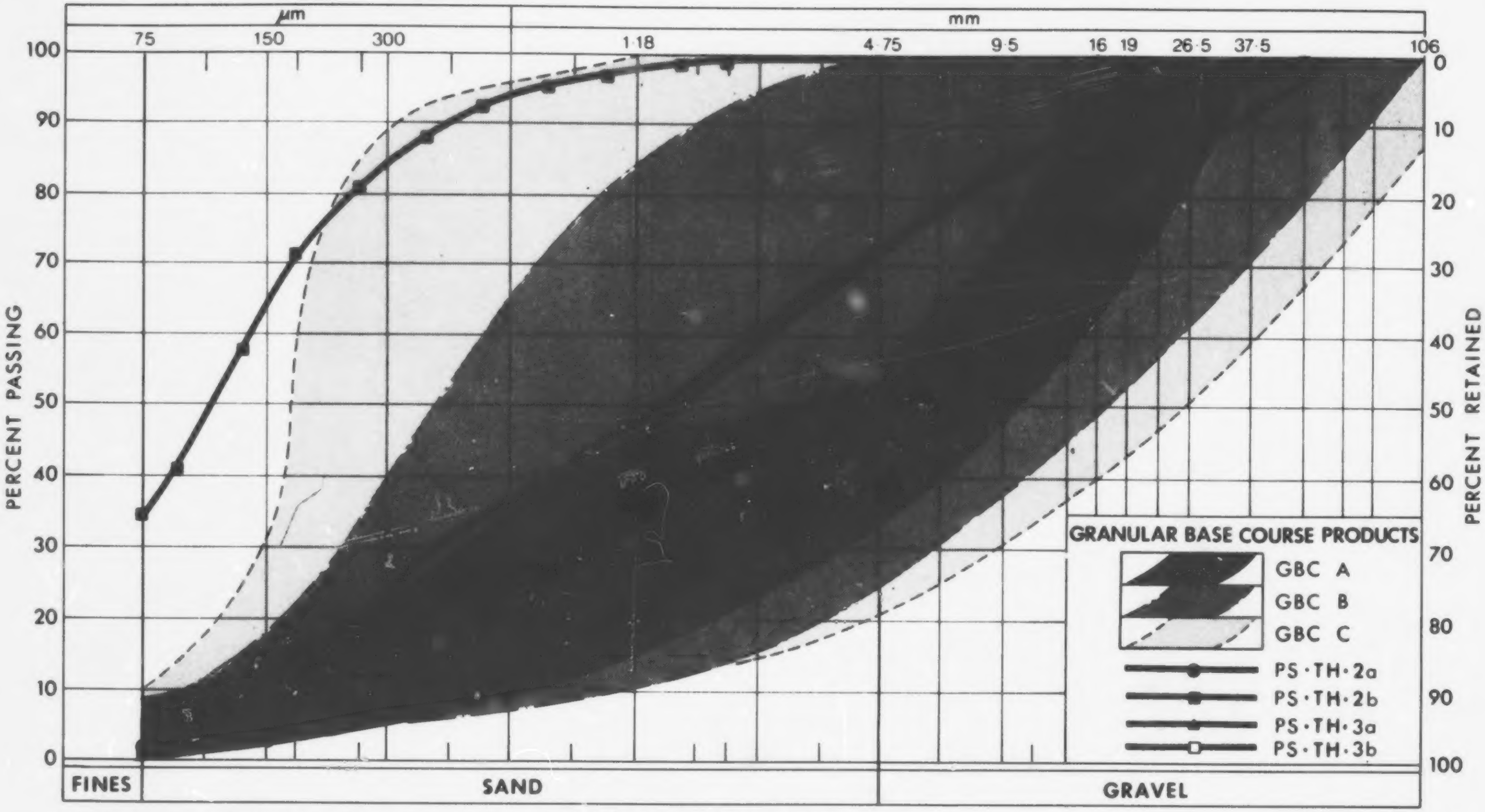


FIGURE 8a: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

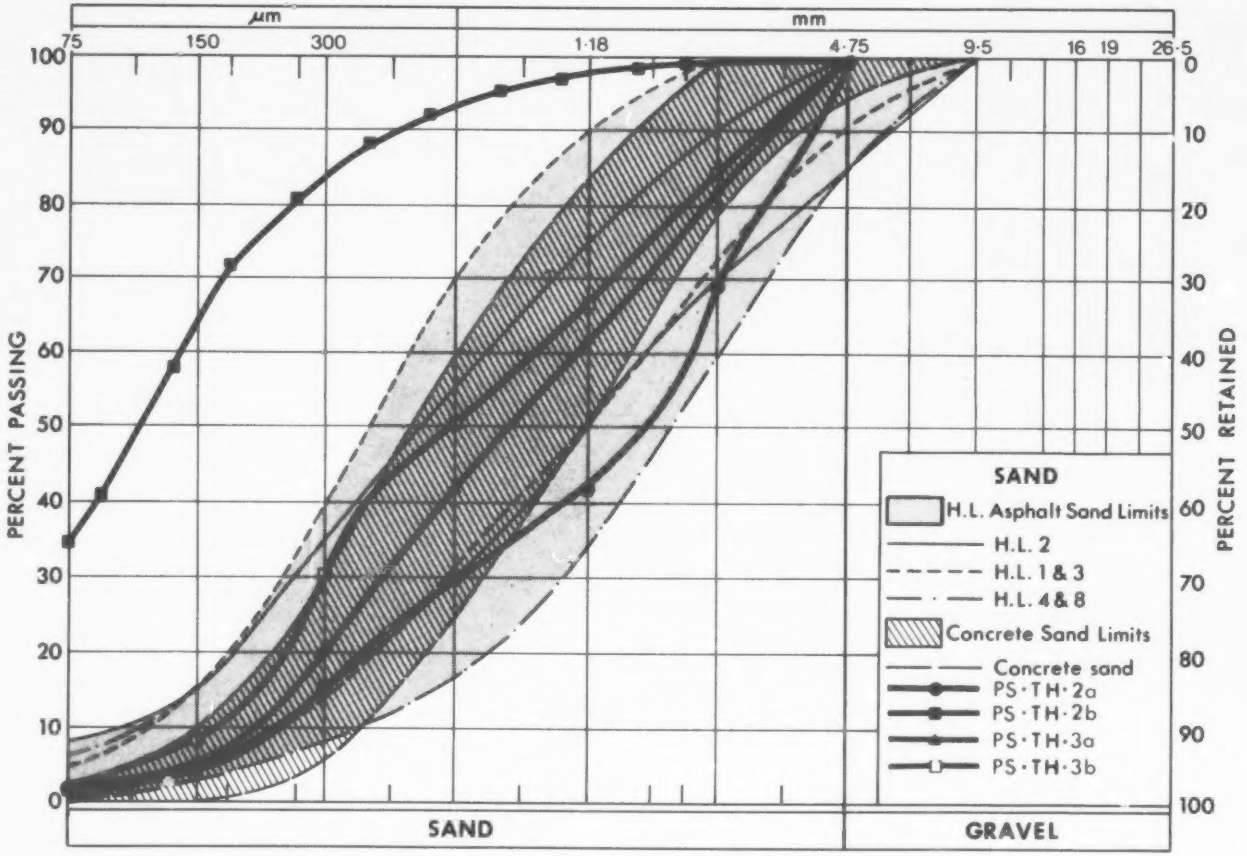


FIGURE 8b AGGREGATE GRADING CURVES, BYNG INLET MAP AREA;

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

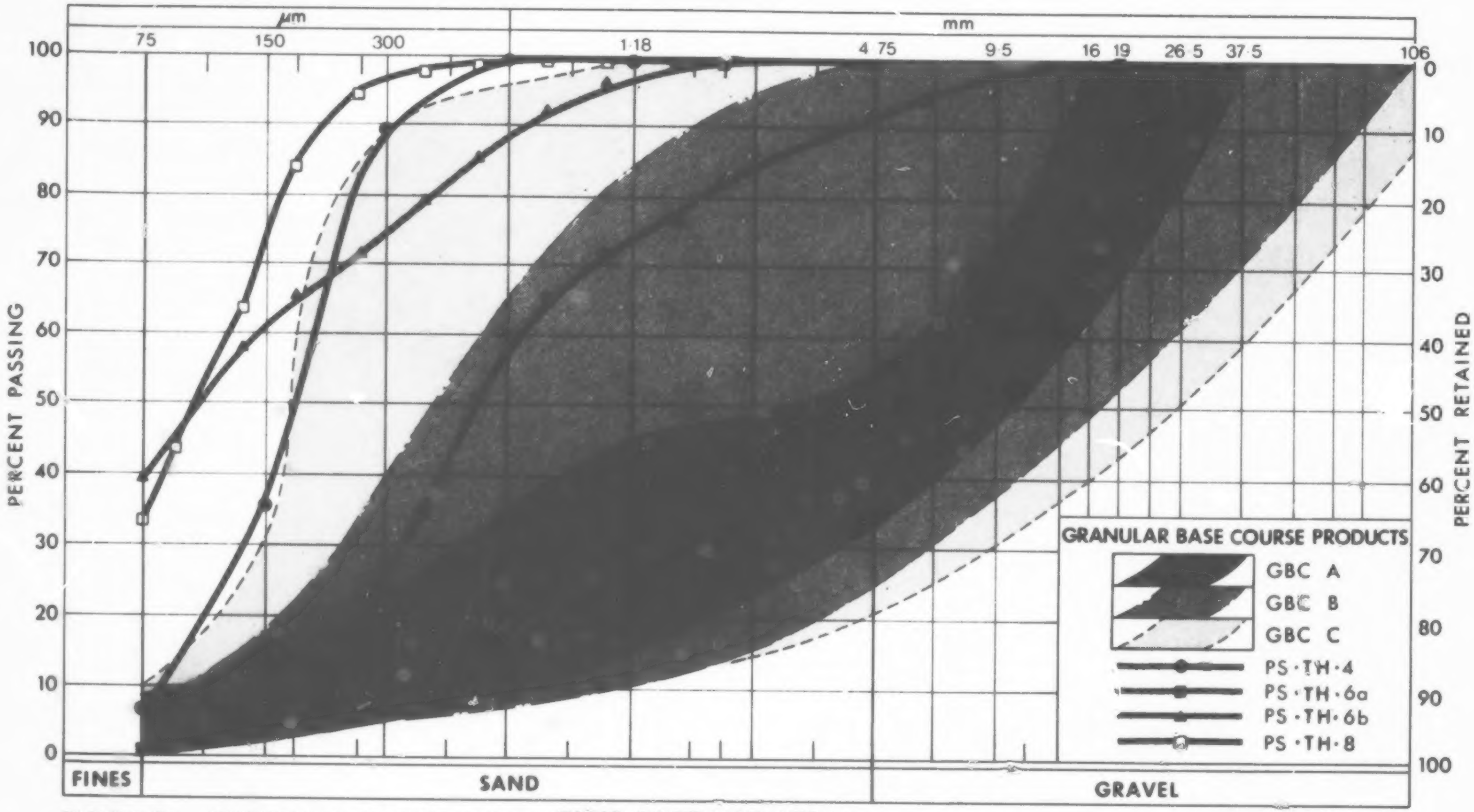


FIGURE 9a: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

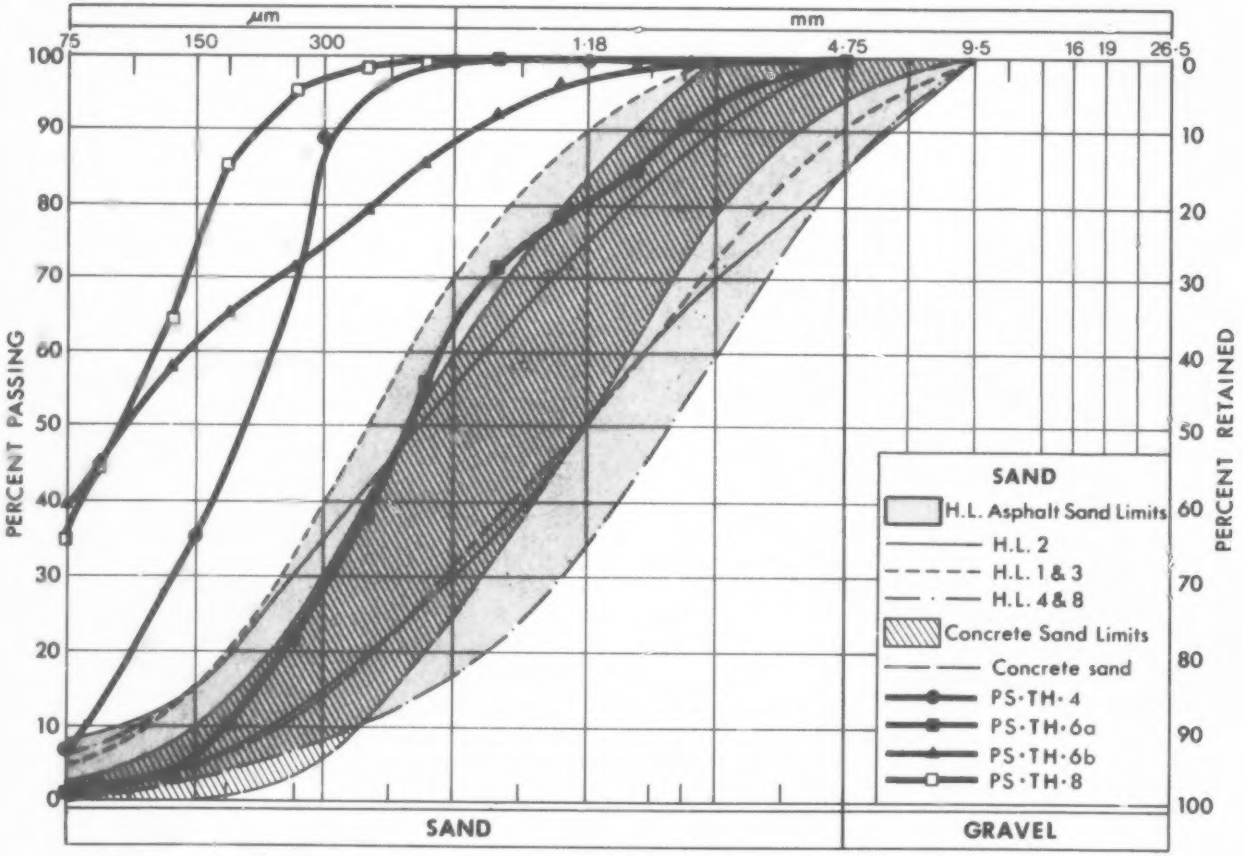


FIGURE 9b: AGGREGATE GRADING CURVES, **BYNG INLET MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

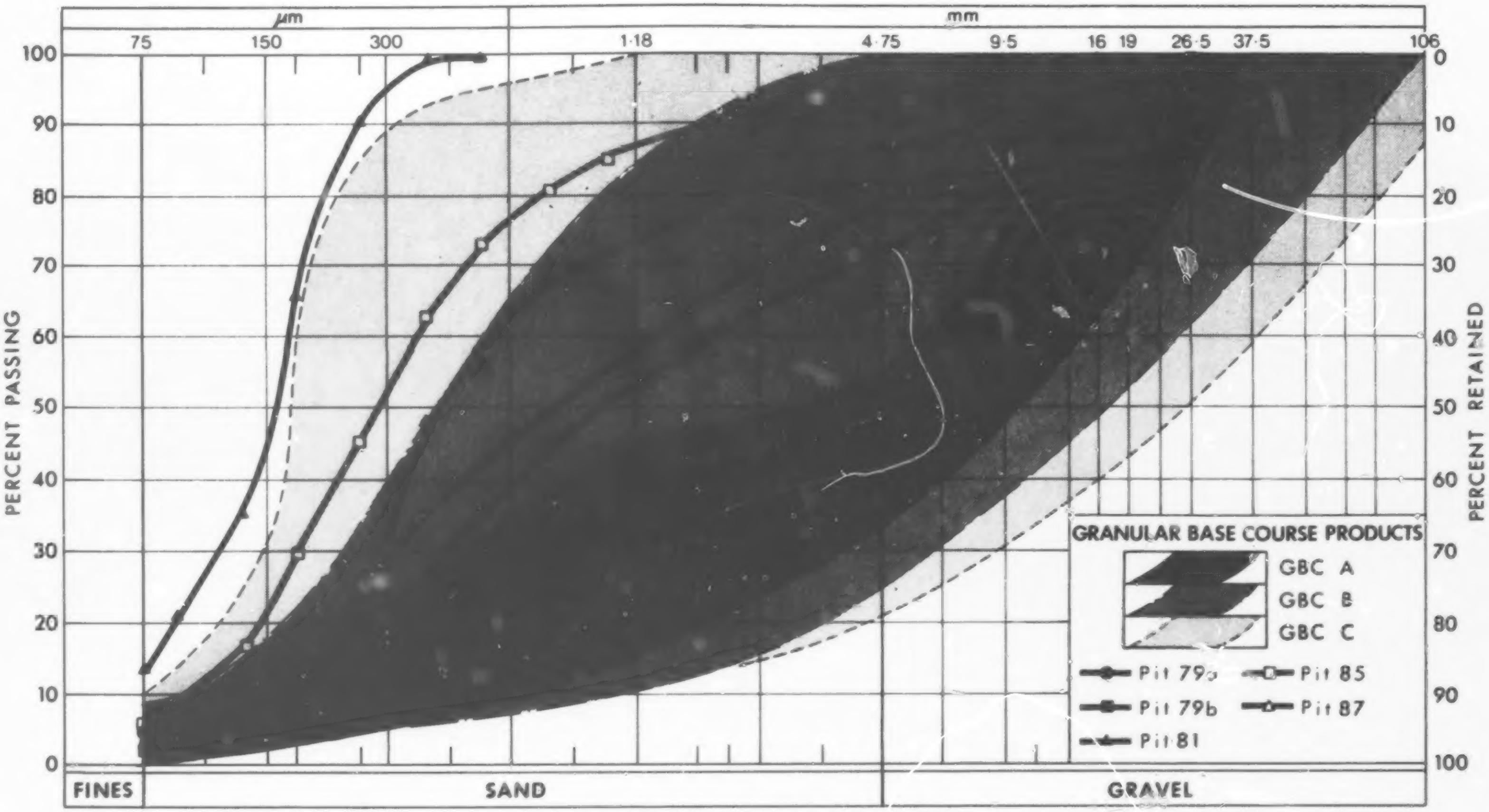


FIGURE 10a: AGGREGATE GRADING CURVES, POINTE AU BARIL STATION MAP AREA:

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

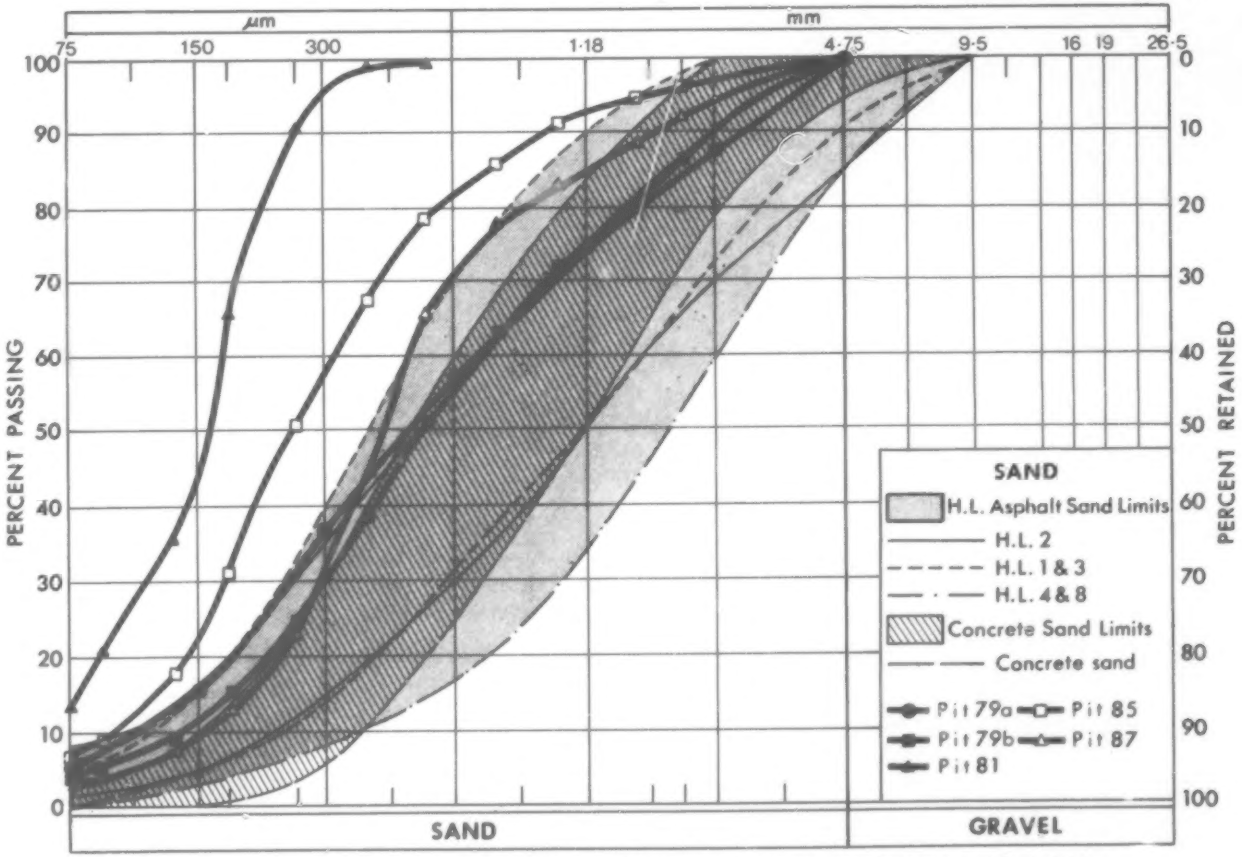


FIGURE 10b: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

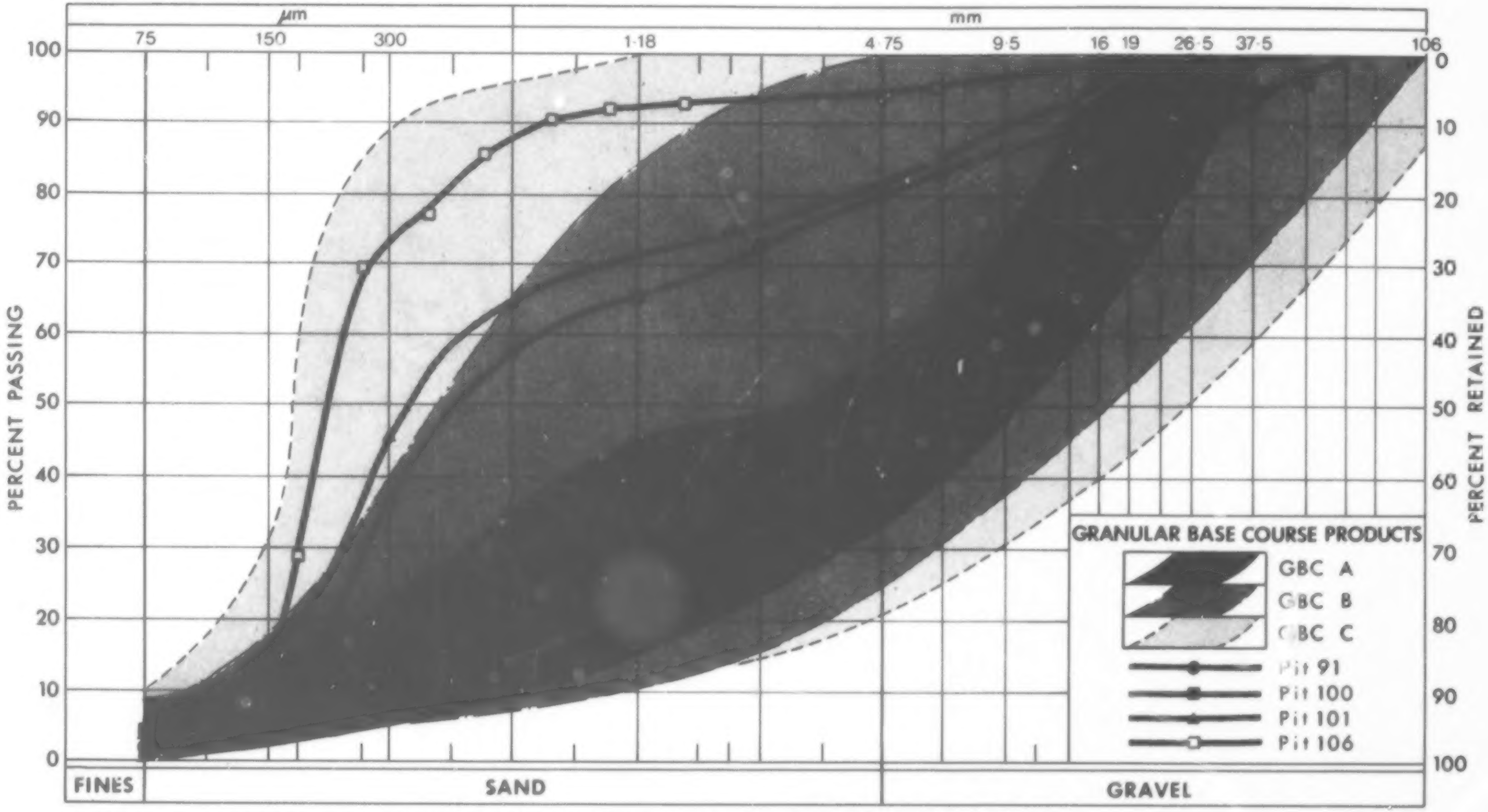


FIGURE 11a: AGGREGATE GRADING CURVES, POINTE AU BARIL STATION MAP AREA:

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

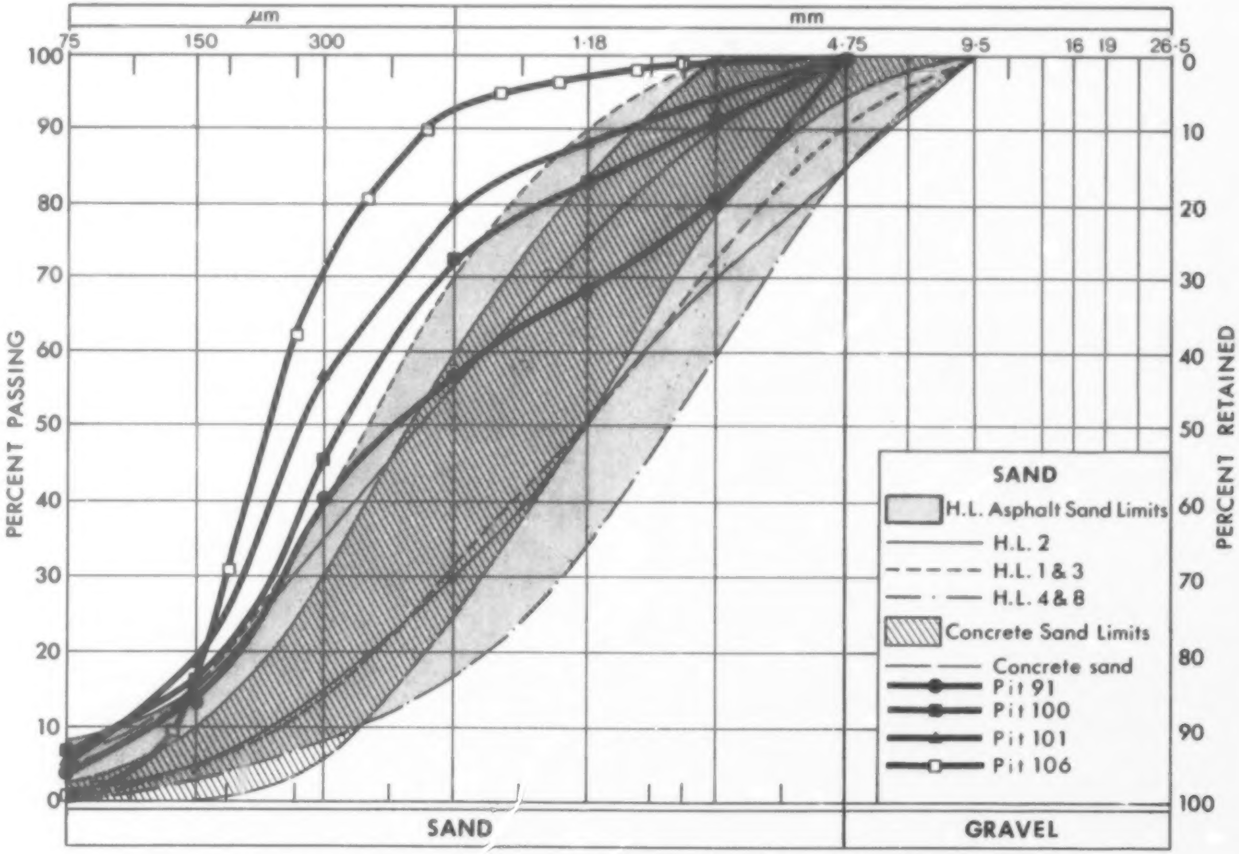


FIGURE 11b: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

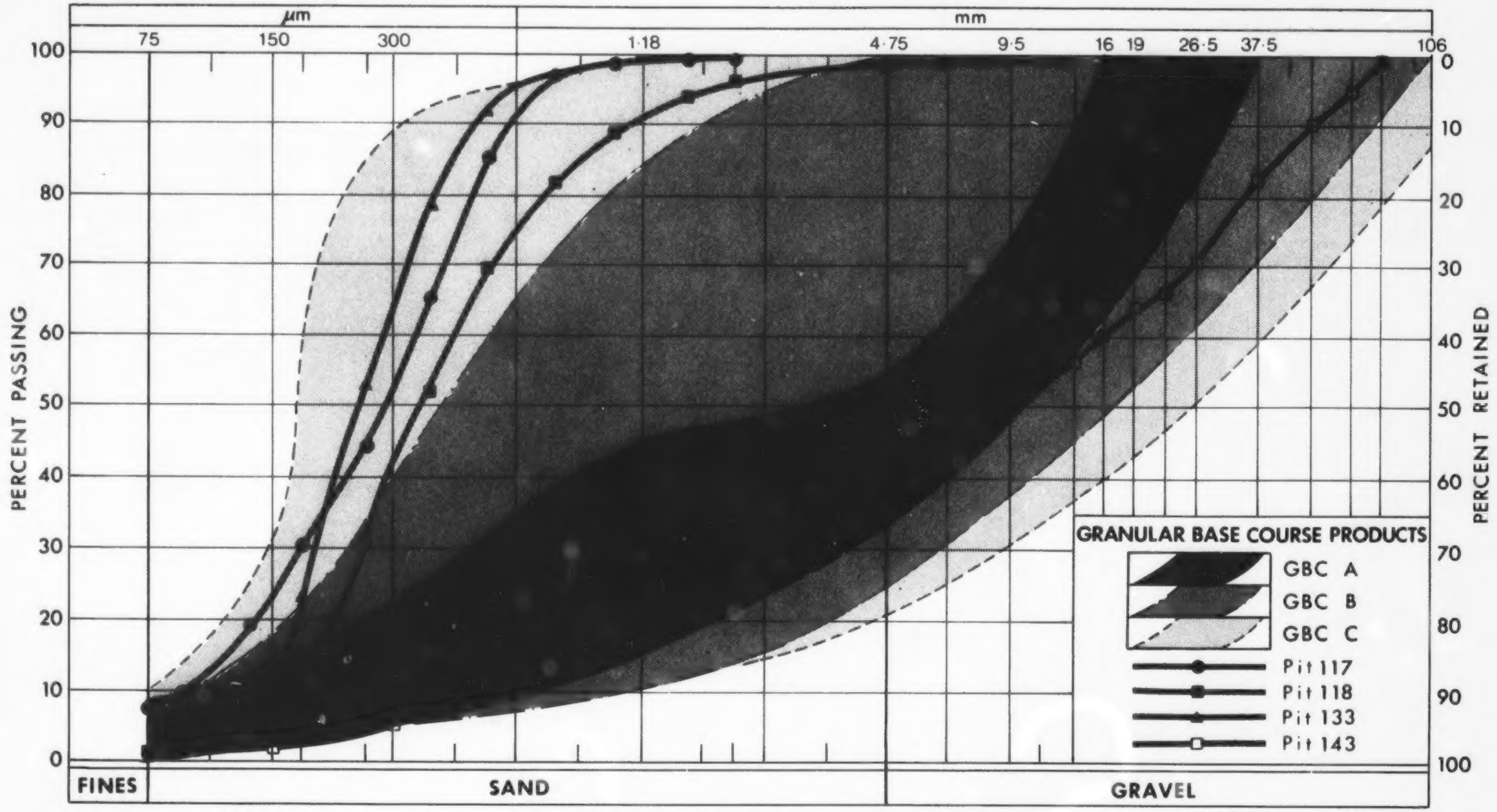


FIGURE 12a: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

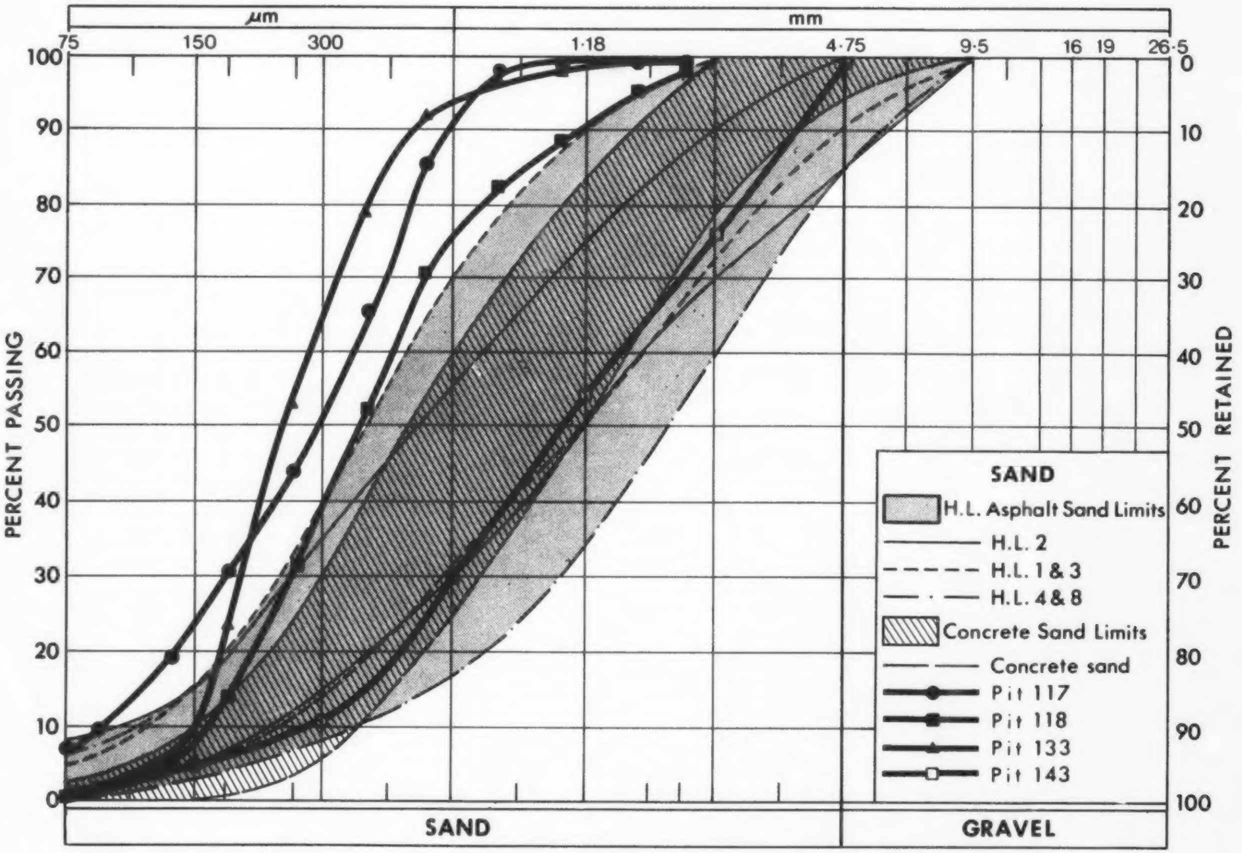


FIGURE 12b: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

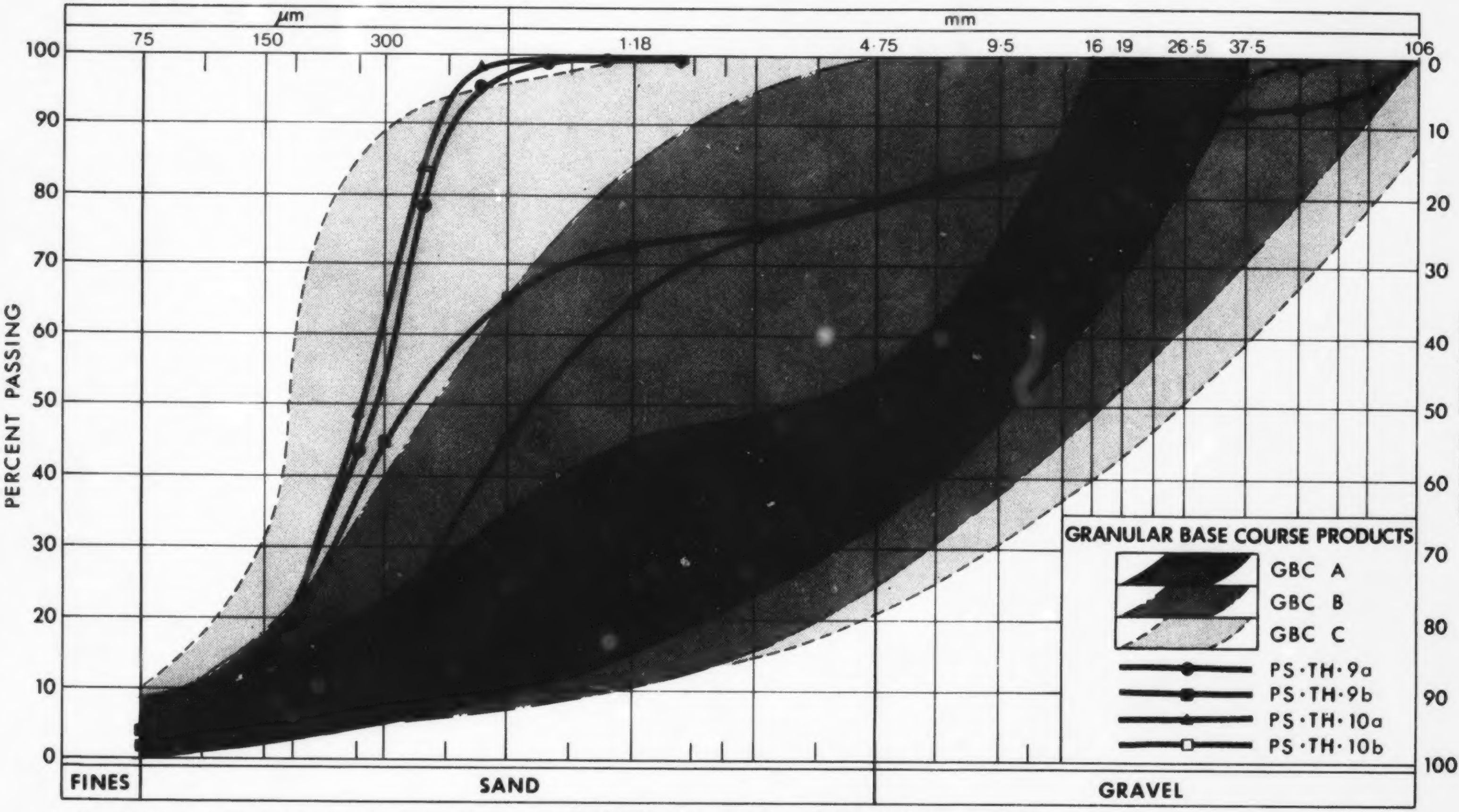


FIGURE 13a: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

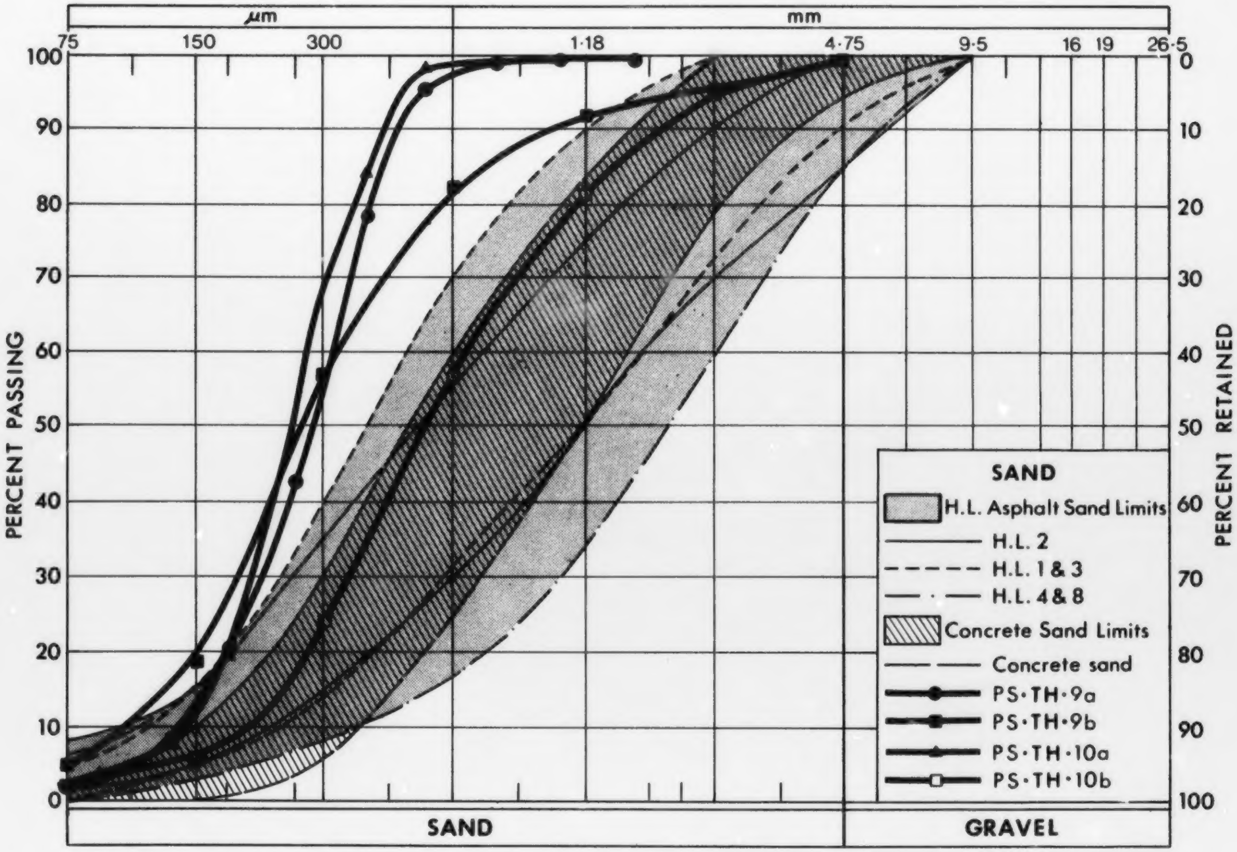


FIGURE 13b: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

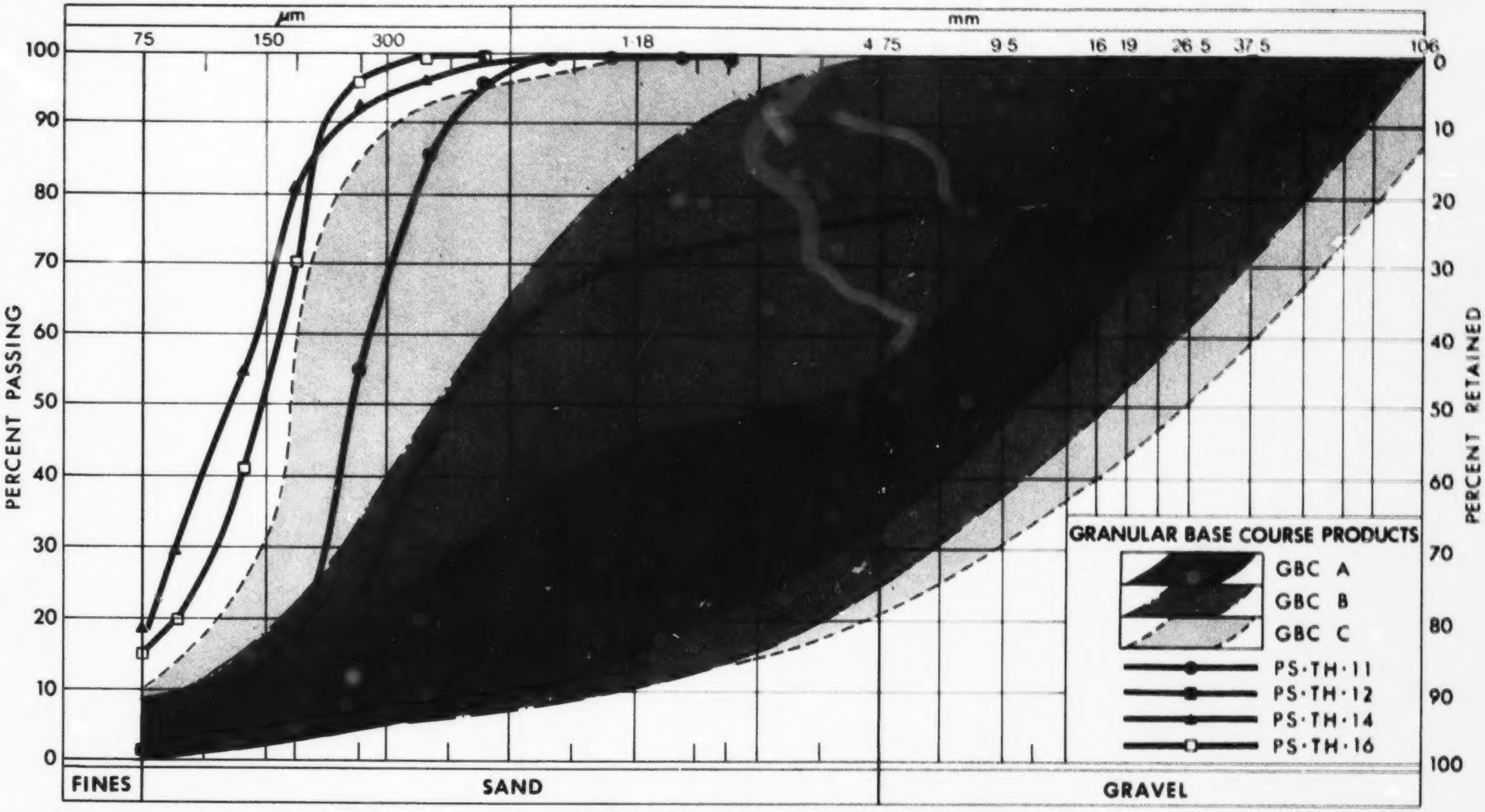


FIGURE 14a: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA ;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

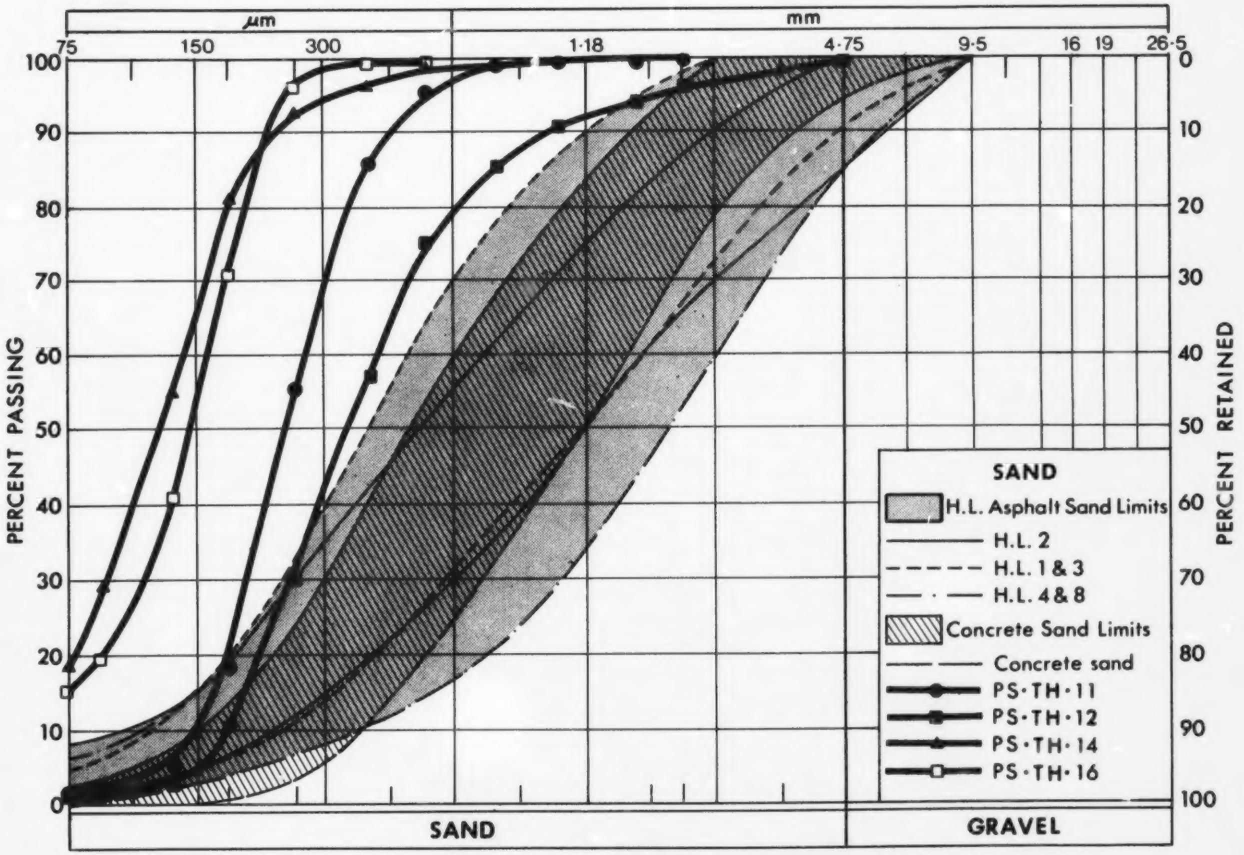


FIGURE 14b: AGGREGATE GRADING CURVES, POINTE AU BARIL STATION MAP AREA;

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

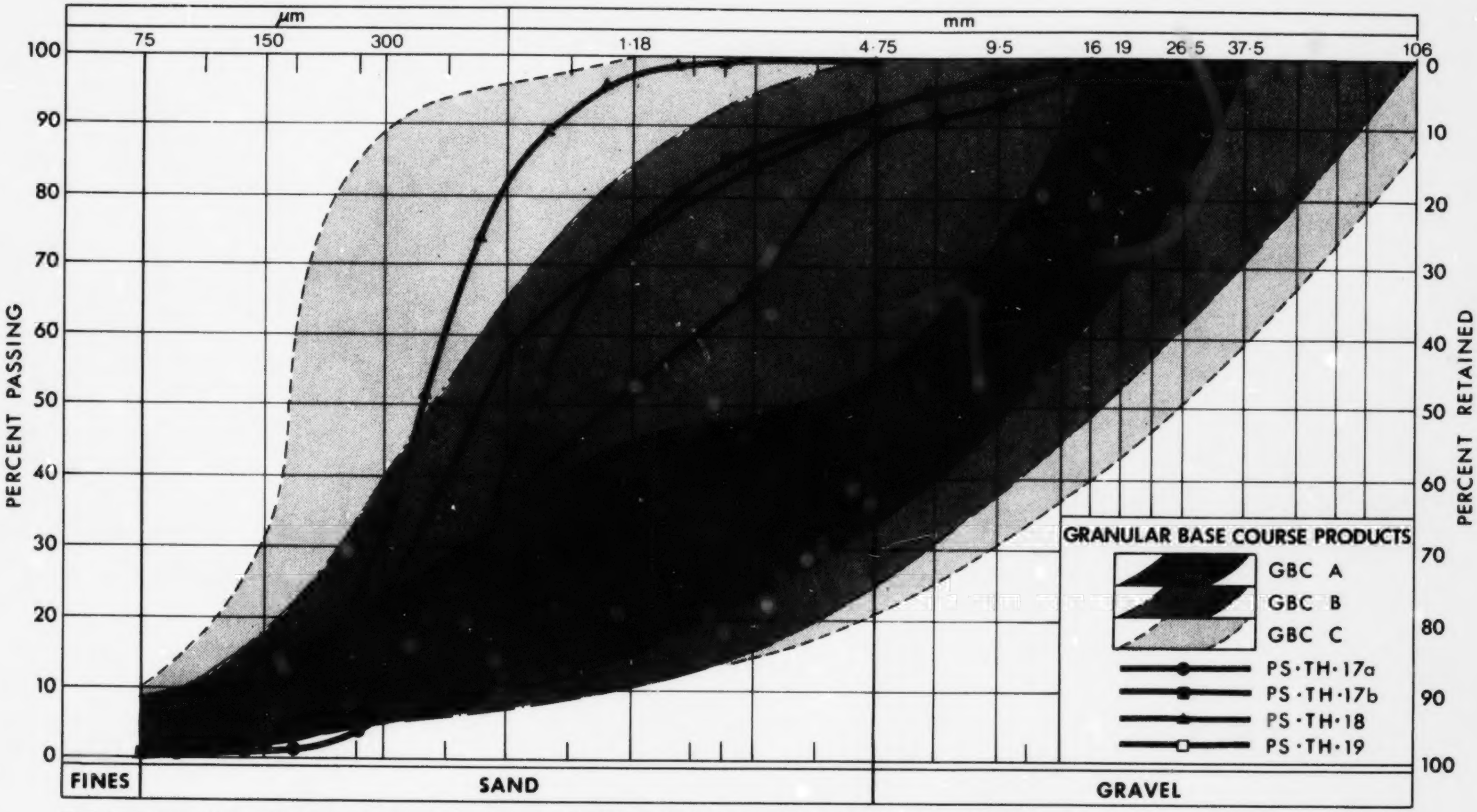


FIGURE 15a: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

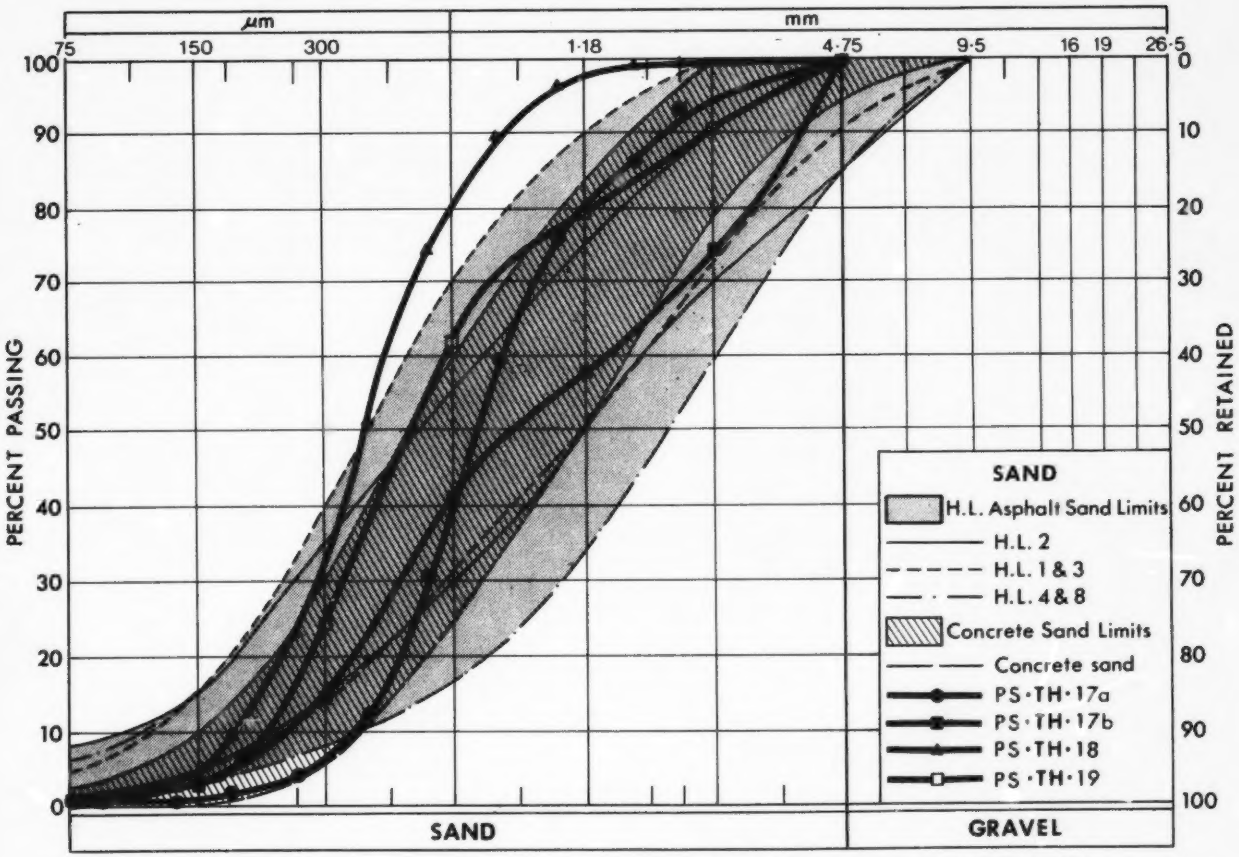


FIGURE 15b: AGGREGATE GRADING CURVES, POINTE AU BARIL STATION MAP AREA;

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

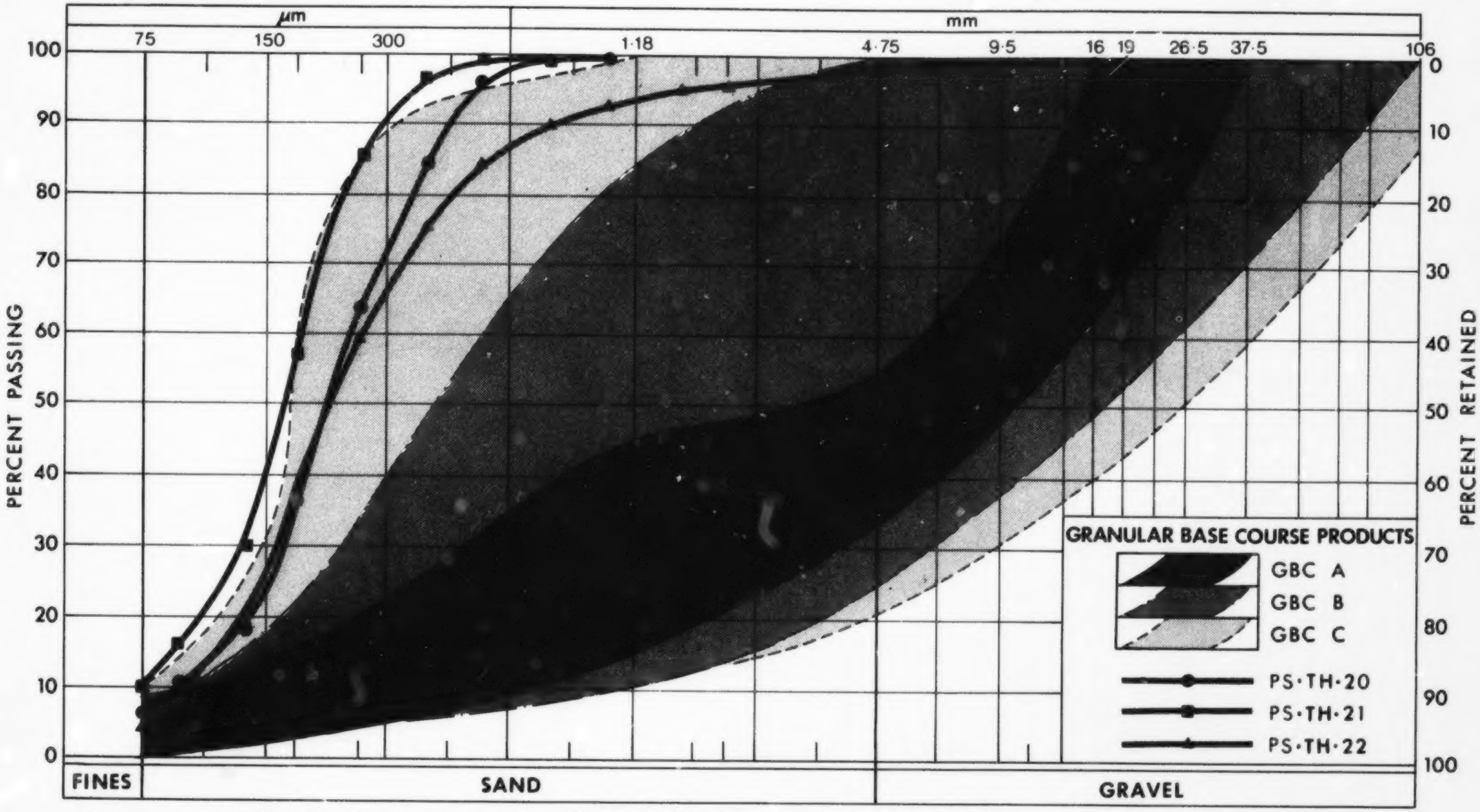


FIGURE 16a: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

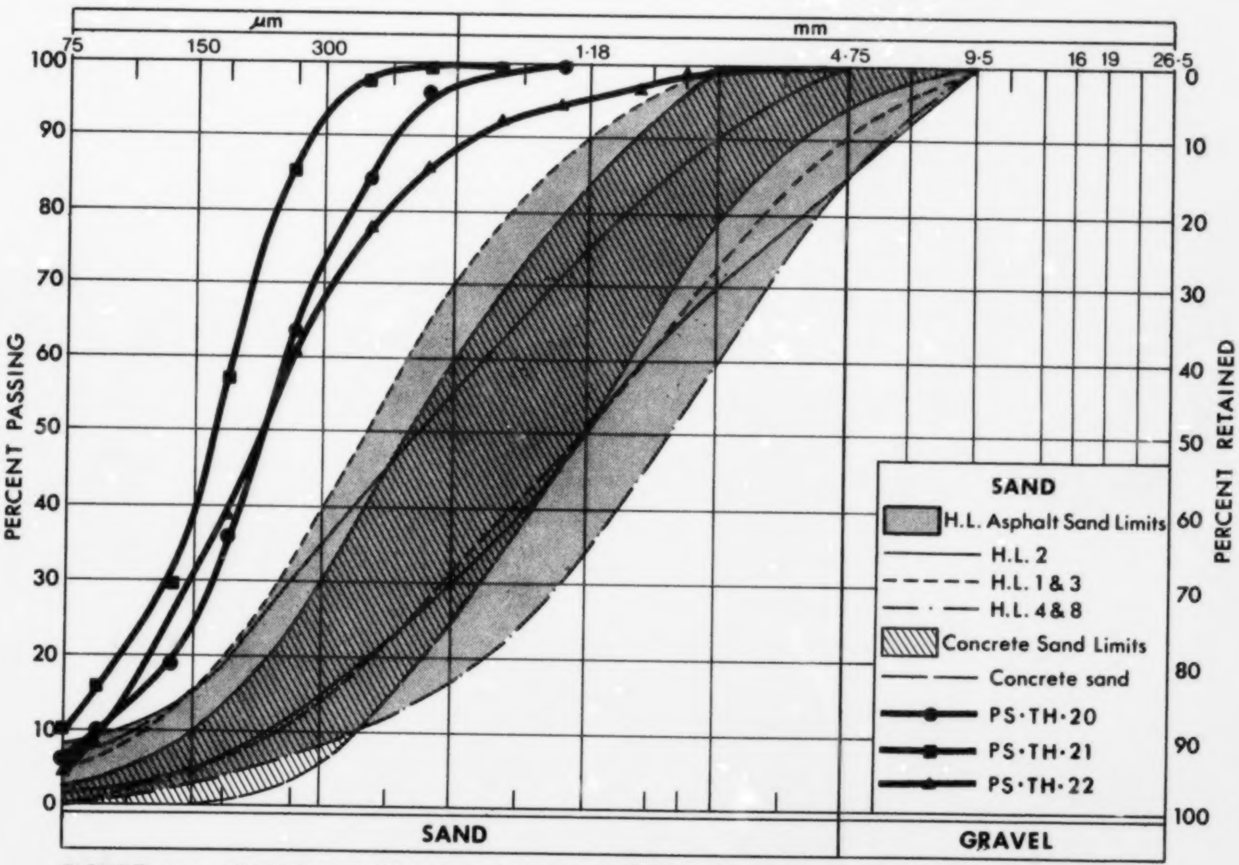


FIGURE 16b: AGGREGATE GRADING CURVES, **POINTE AU BARIL STATION MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

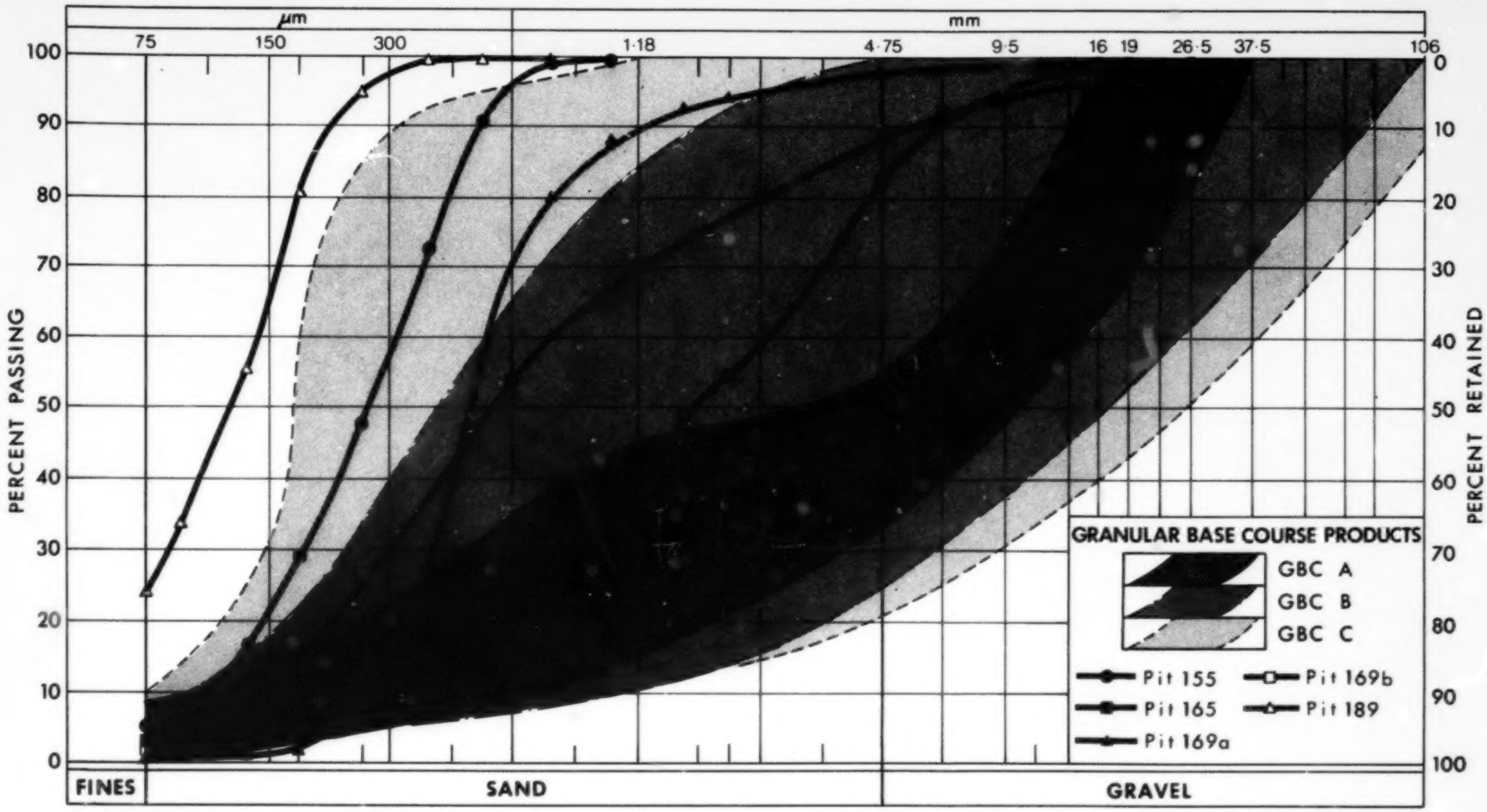


FIGURE 17a: AGGREGATE GRADING CURVES, PARRY SOUND MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

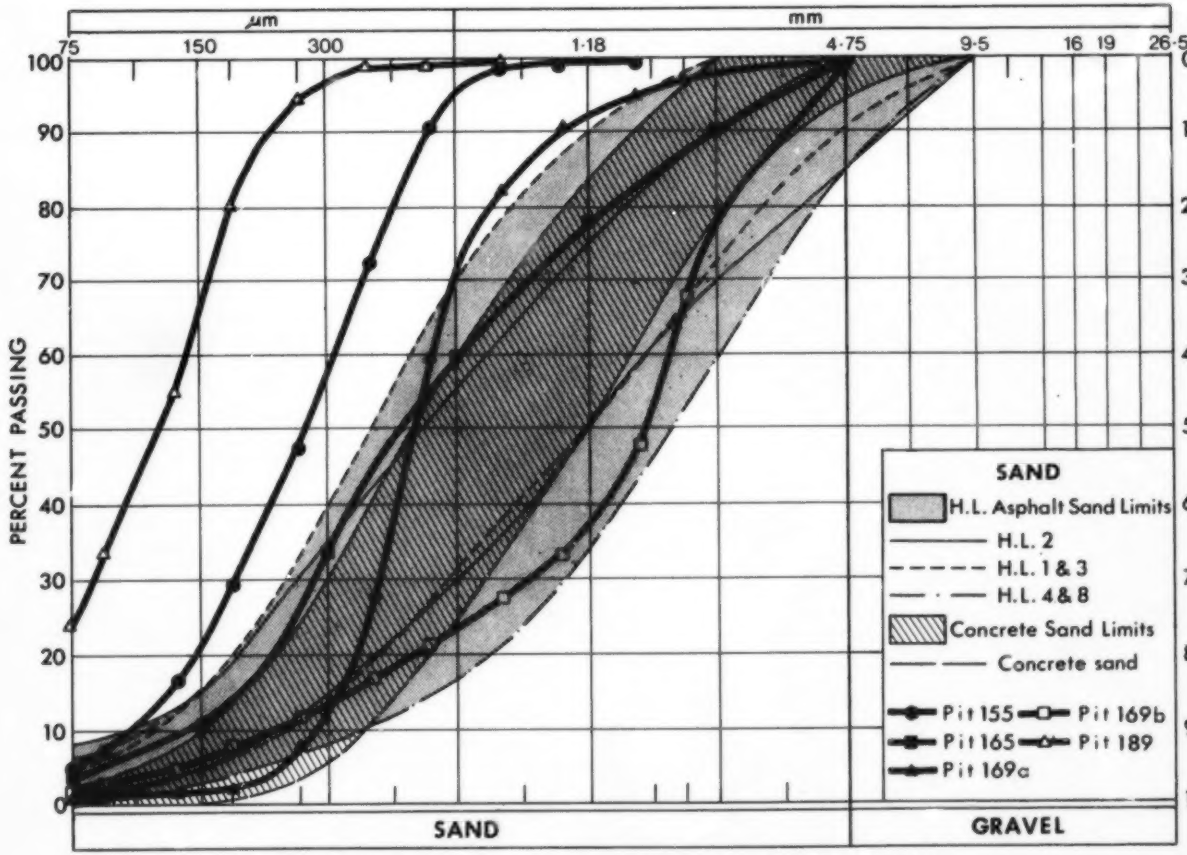


FIGURE 17b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

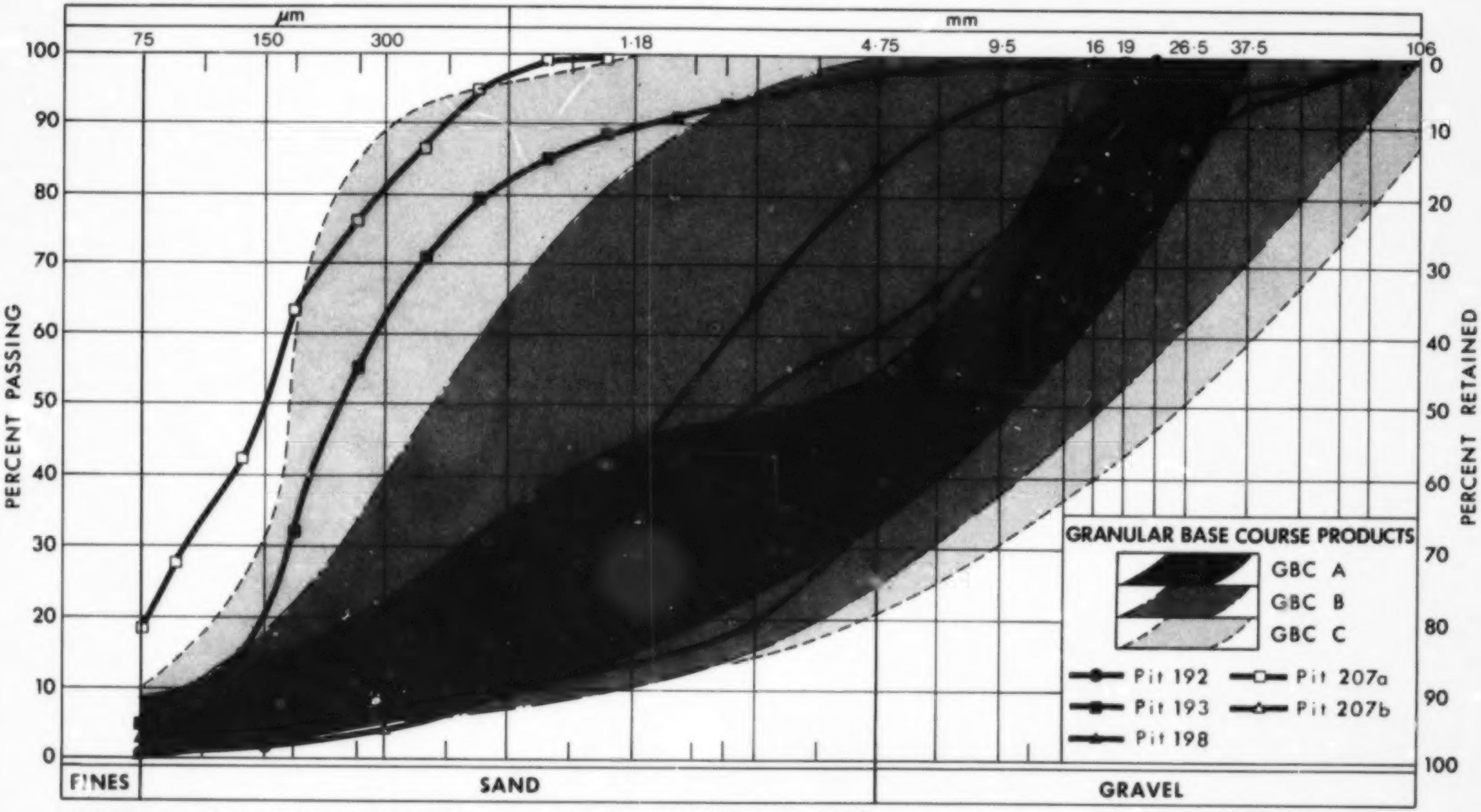


FIGURE 18a: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

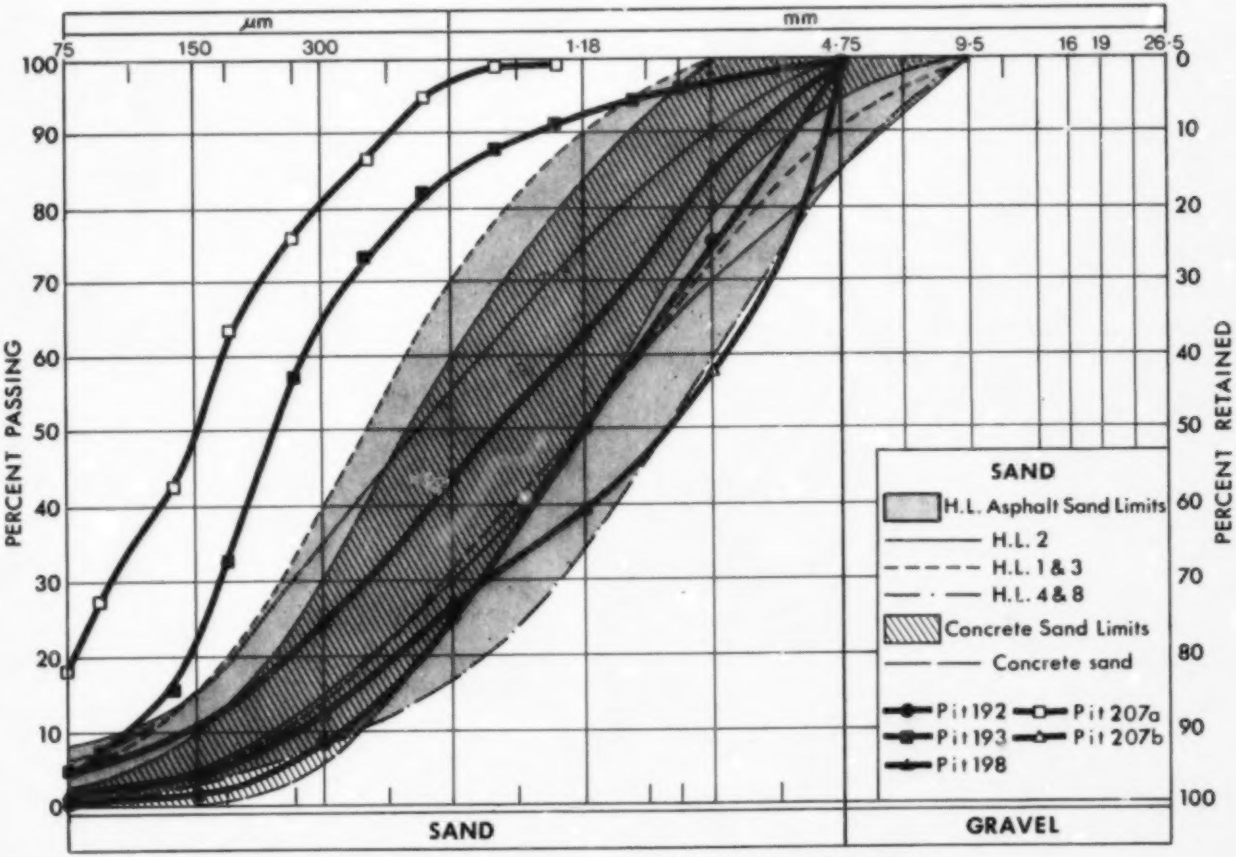


FIGURE 18b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

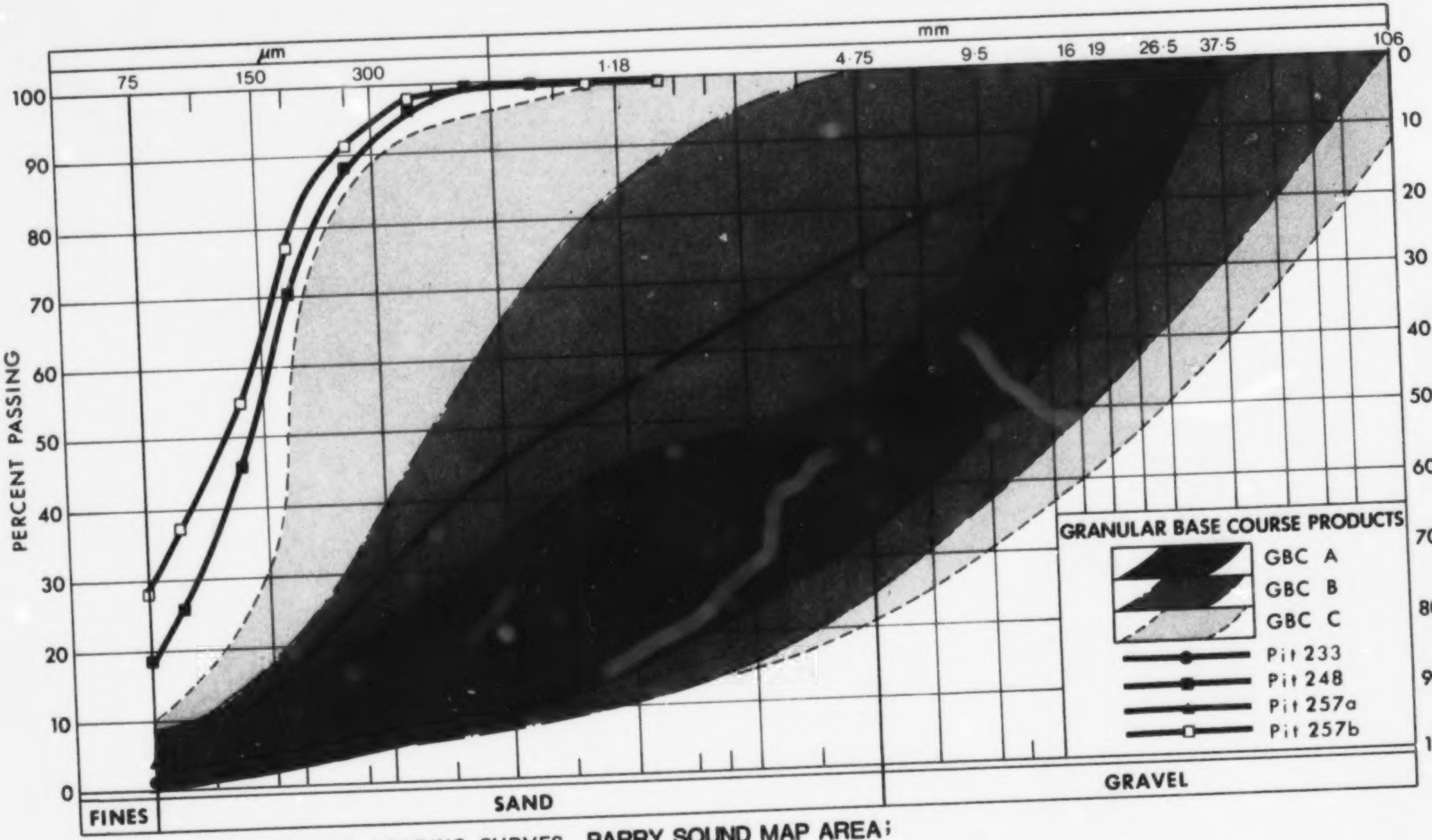


FIGURE 19a: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

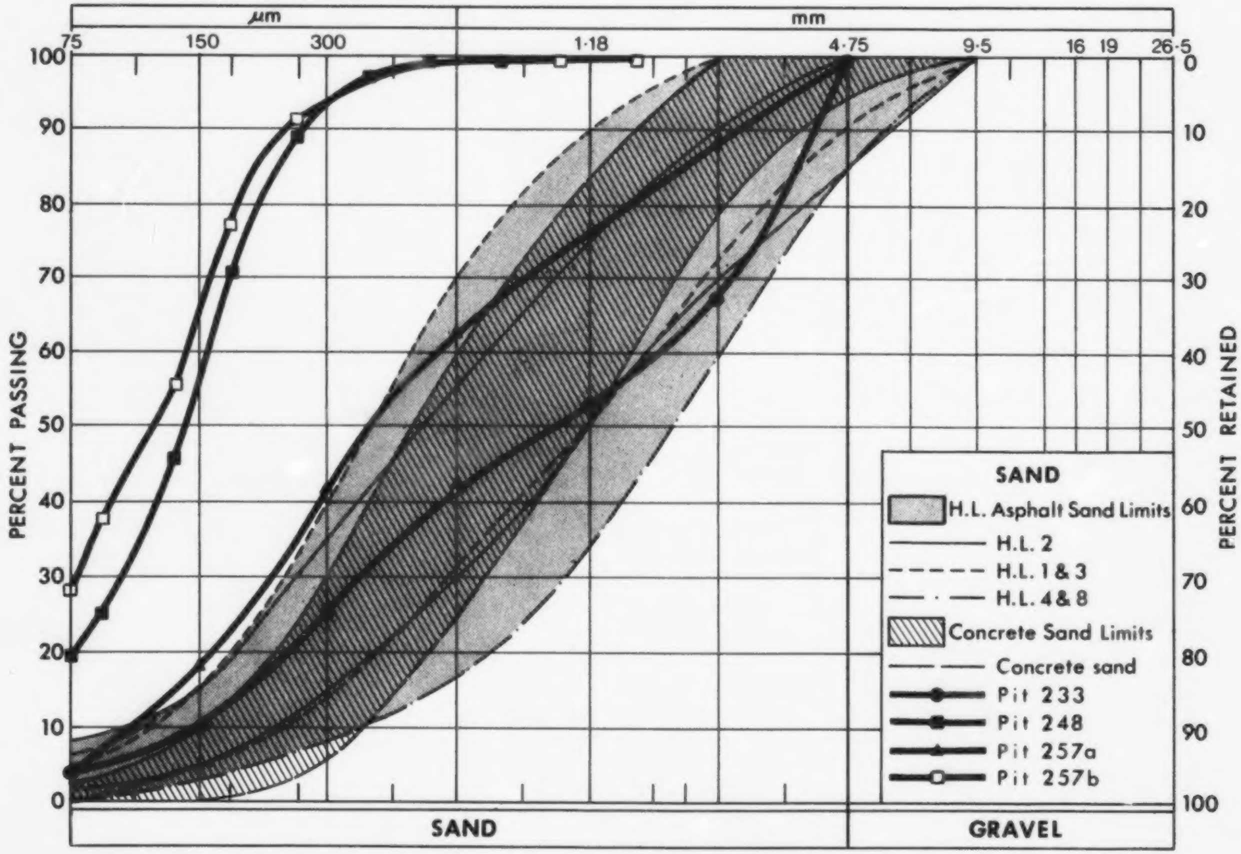


FIGURE 19b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

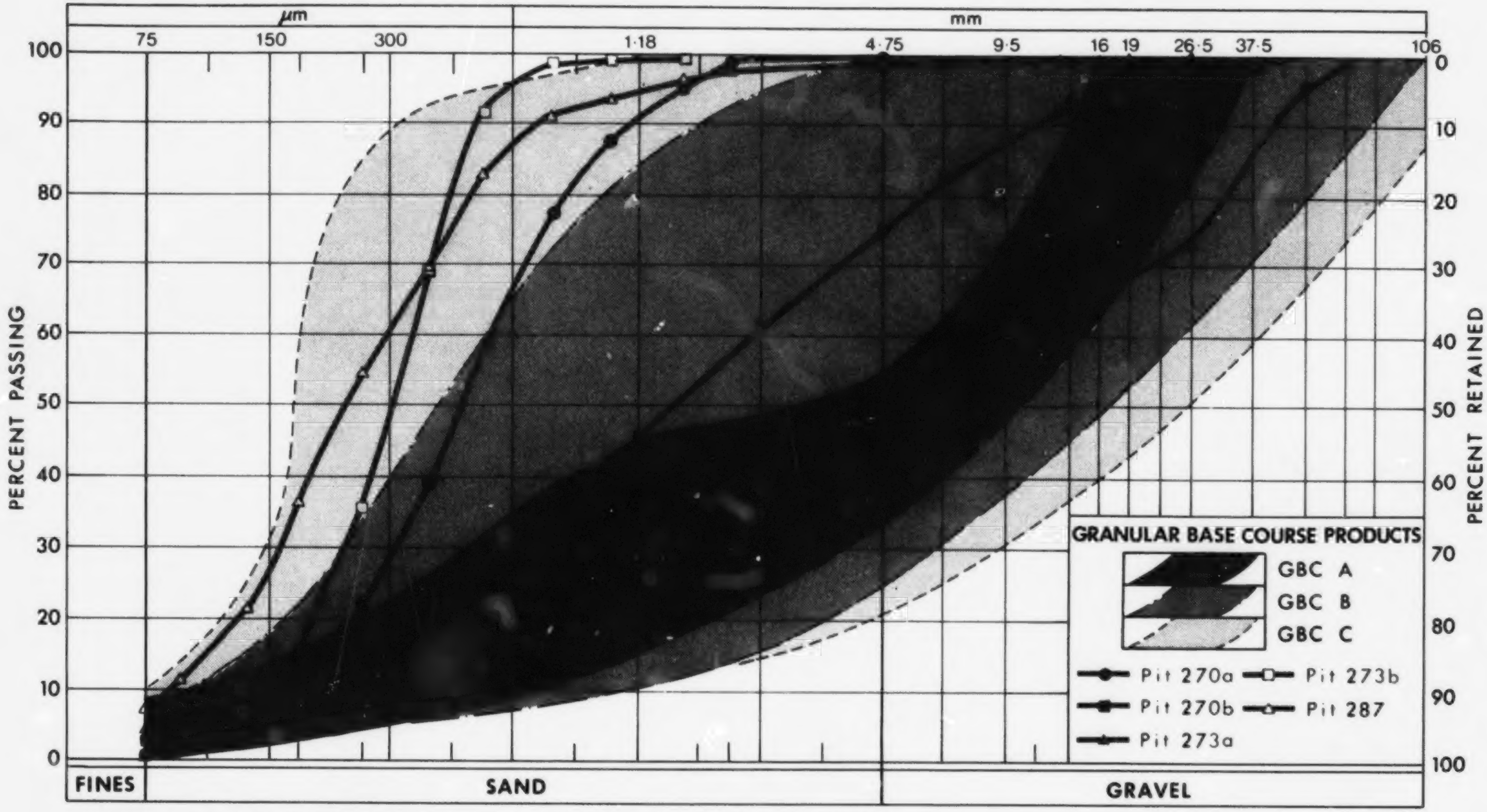


FIGURE 20a: AGGREGATE GRADING CURVES, PARRY SOUND MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

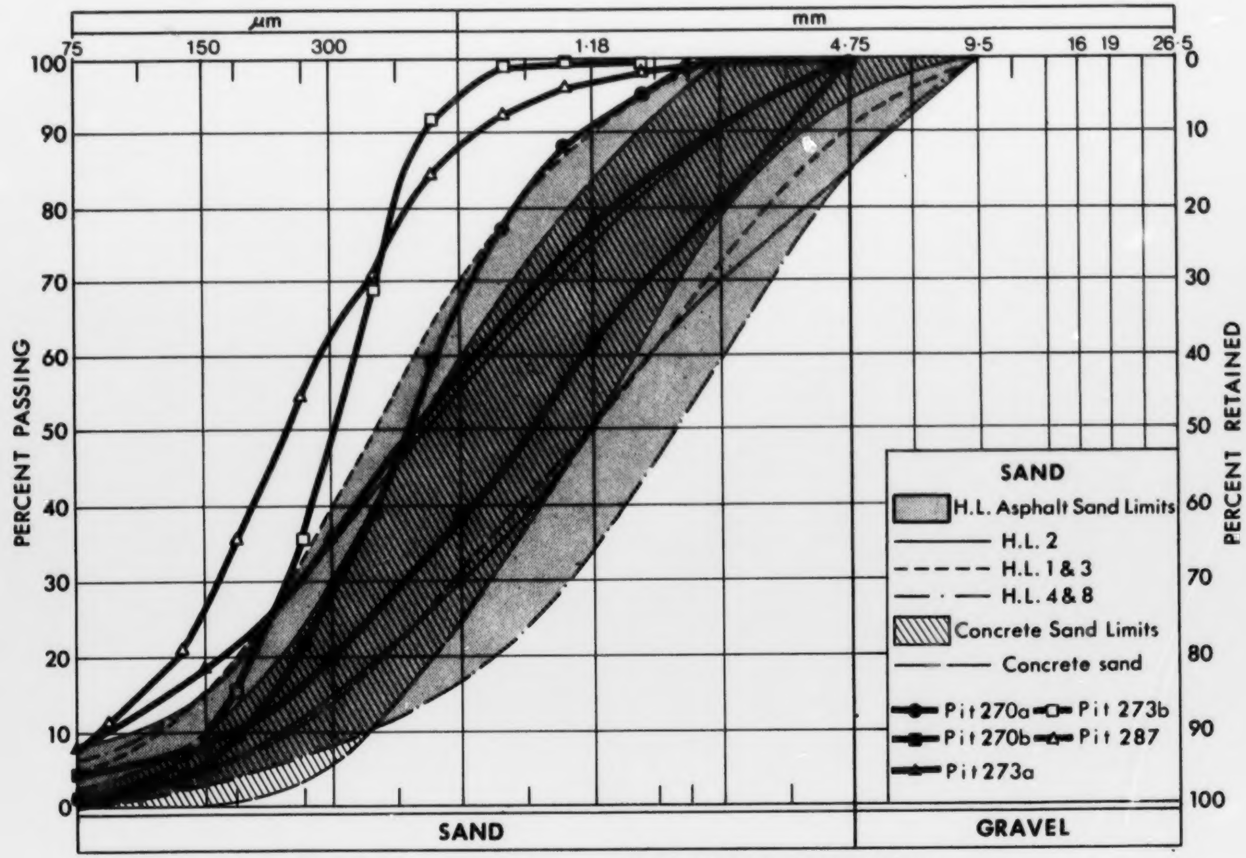


FIGURE 20b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

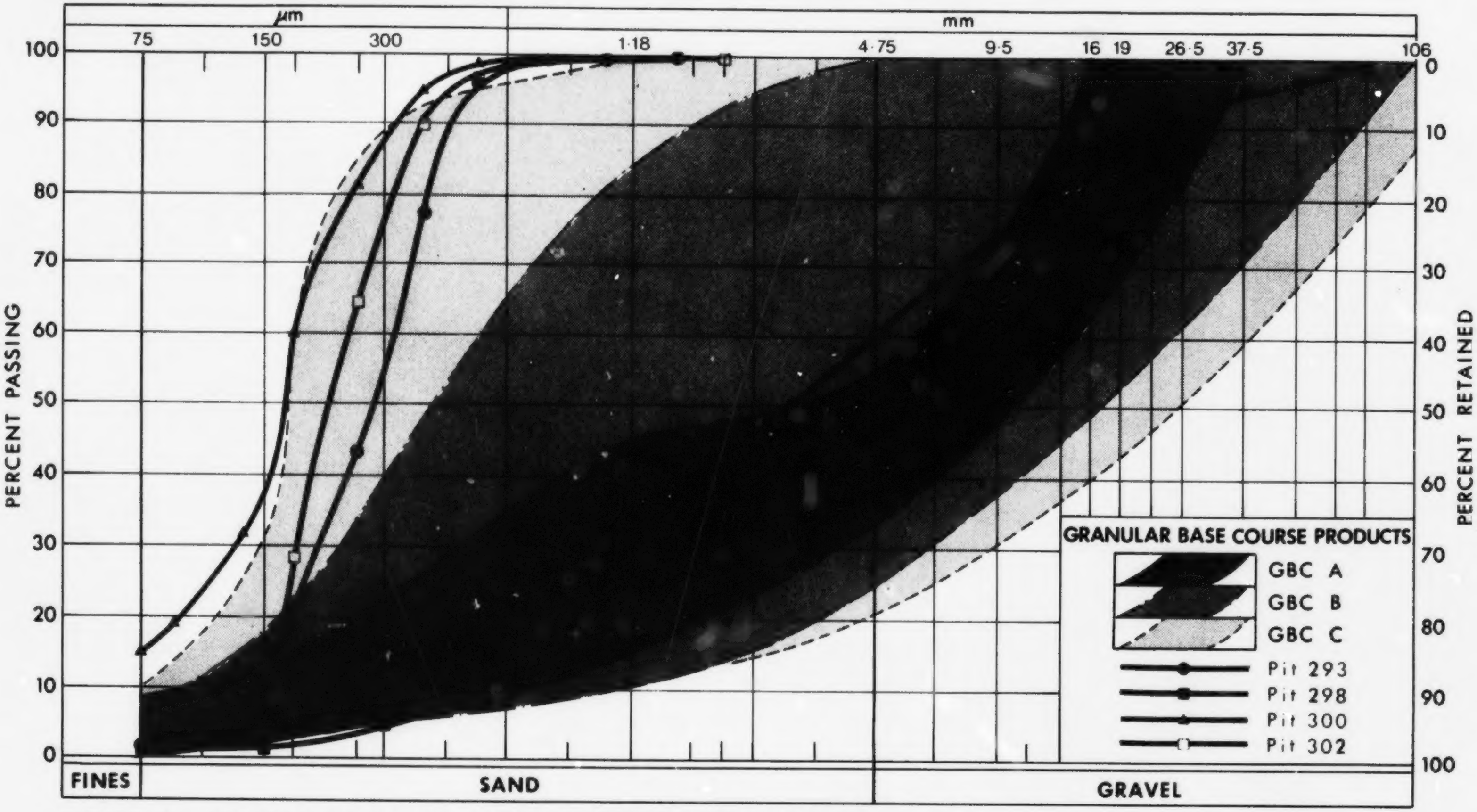


FIGURE 21a: AGGREGATE GRADING CURVES, PARRY SOUND MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

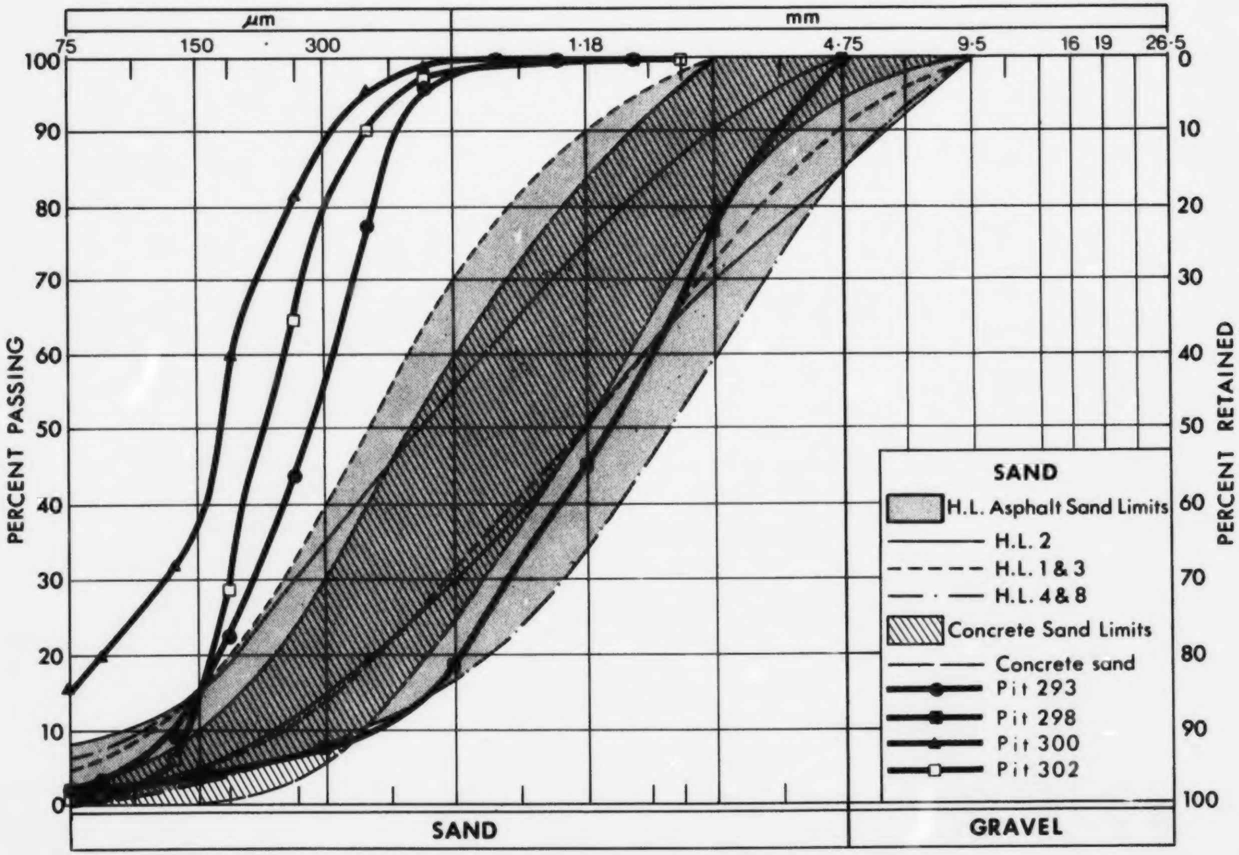


FIGURE 21b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

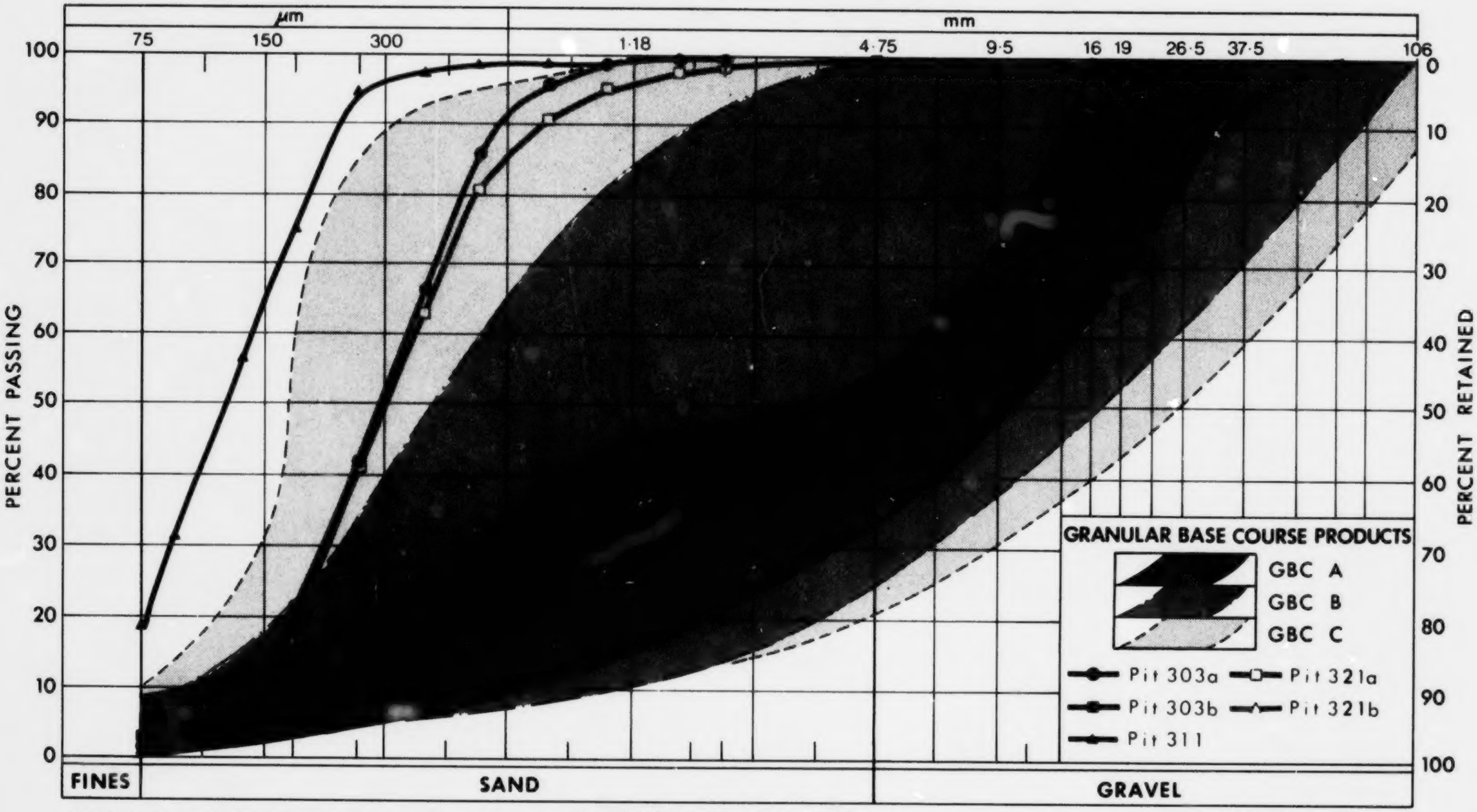


FIGURE 22a: AGGREGATE GRADING CURVES, PARRY SOUND MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

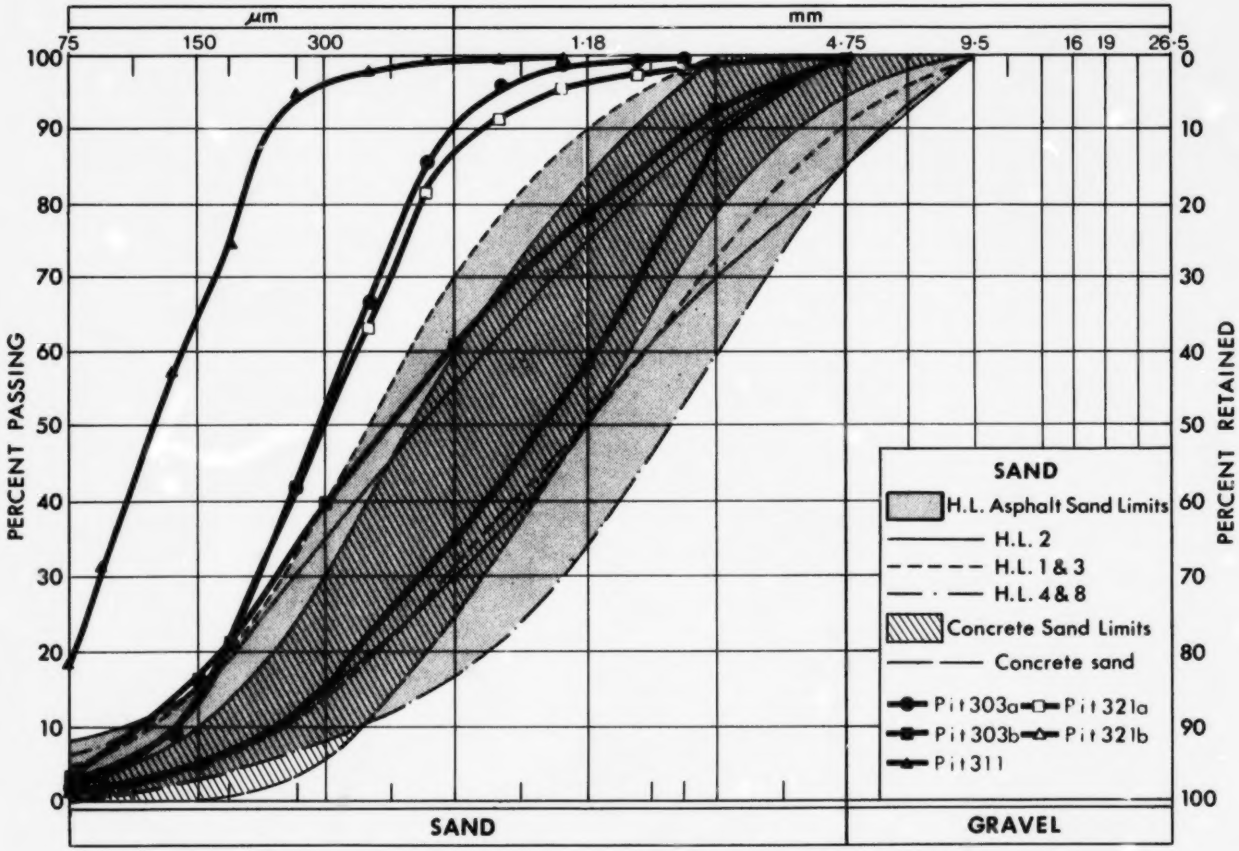


FIGURE 22b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

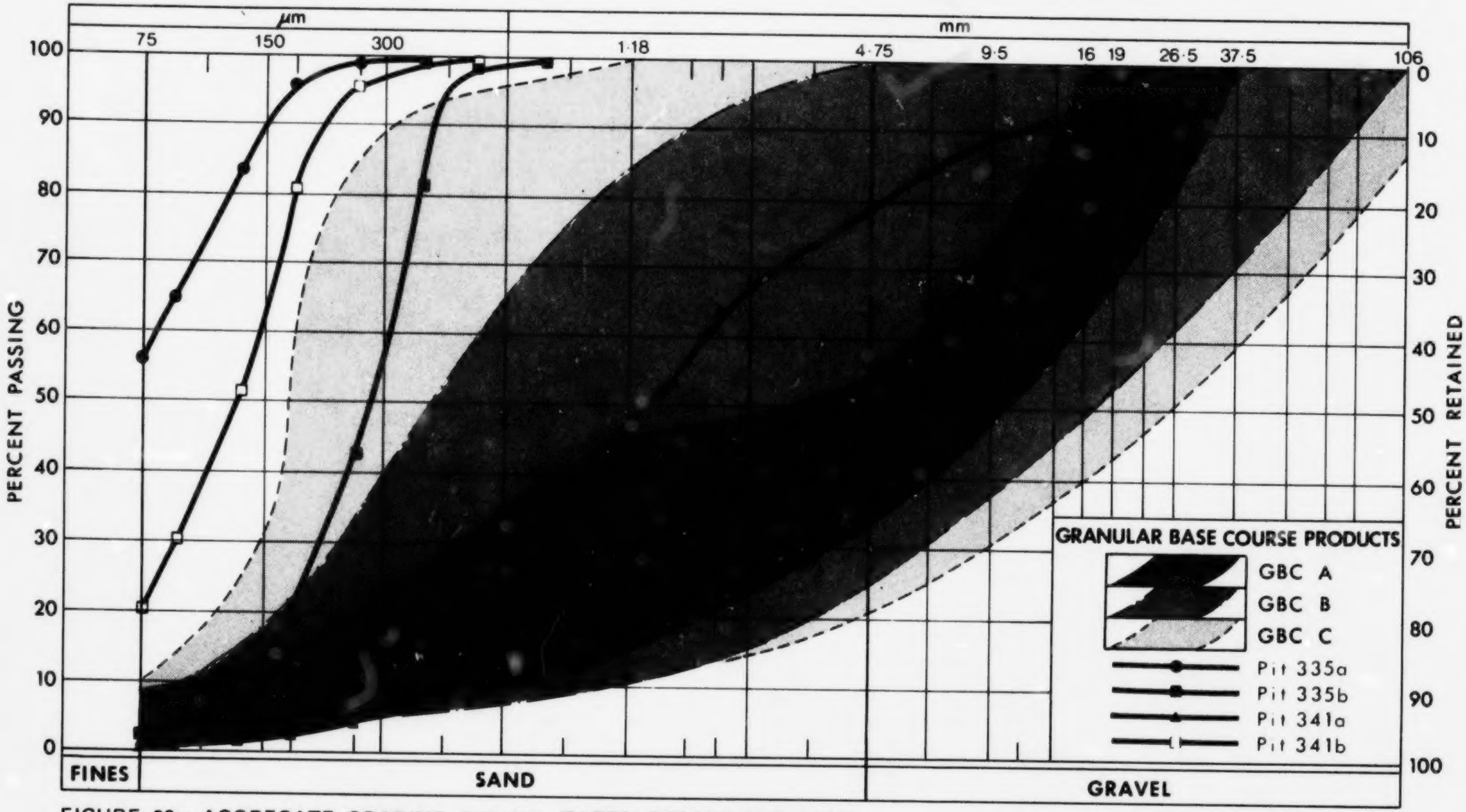


FIGURE 23a: AGGREGATE GRADING CURVES, PARRY SOUND MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

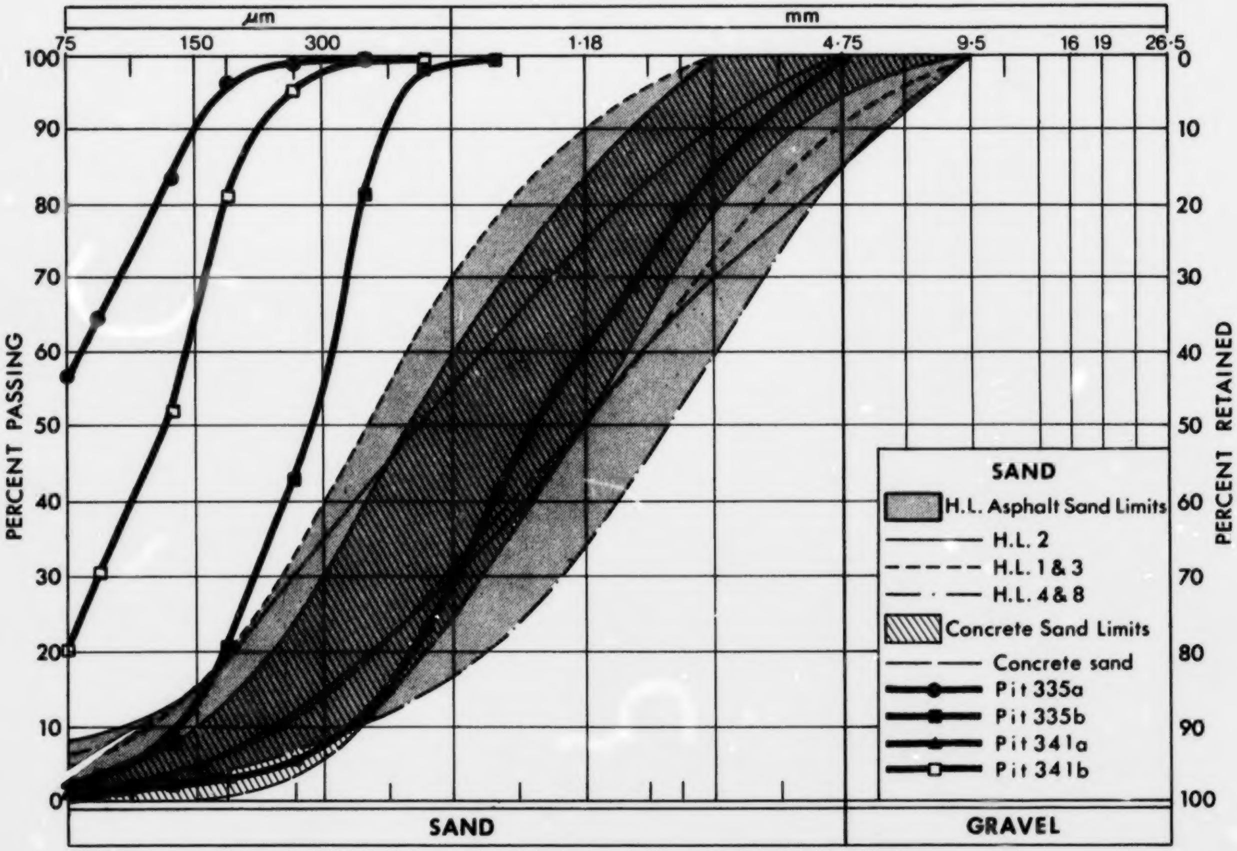


FIGURE 23b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

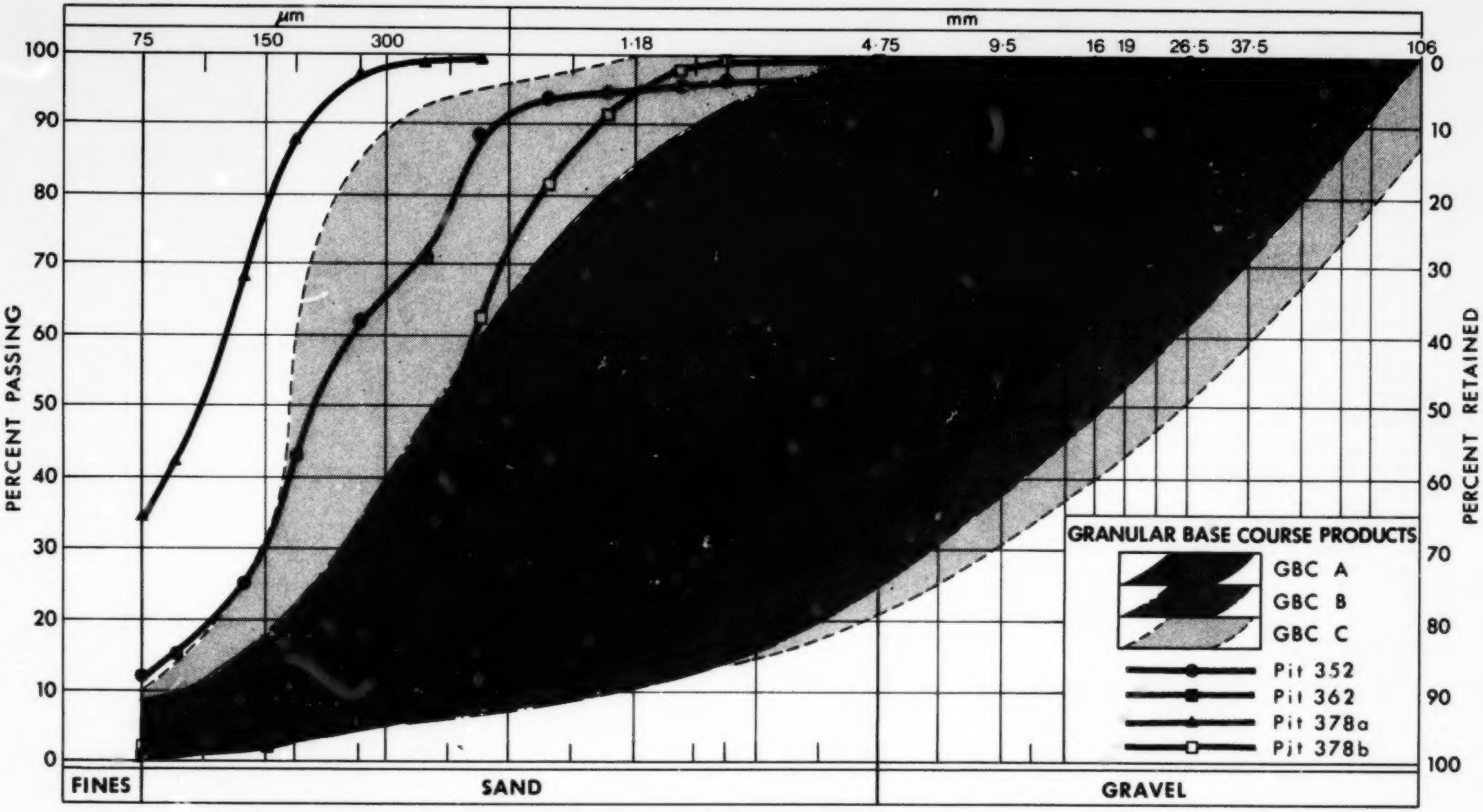


FIGURE 24a: AGGREGATE GRADING CURVES, PARRY SOUND MAP AREA;

Based on analysis of the total aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Form 1010, 1980).

NOTE: Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

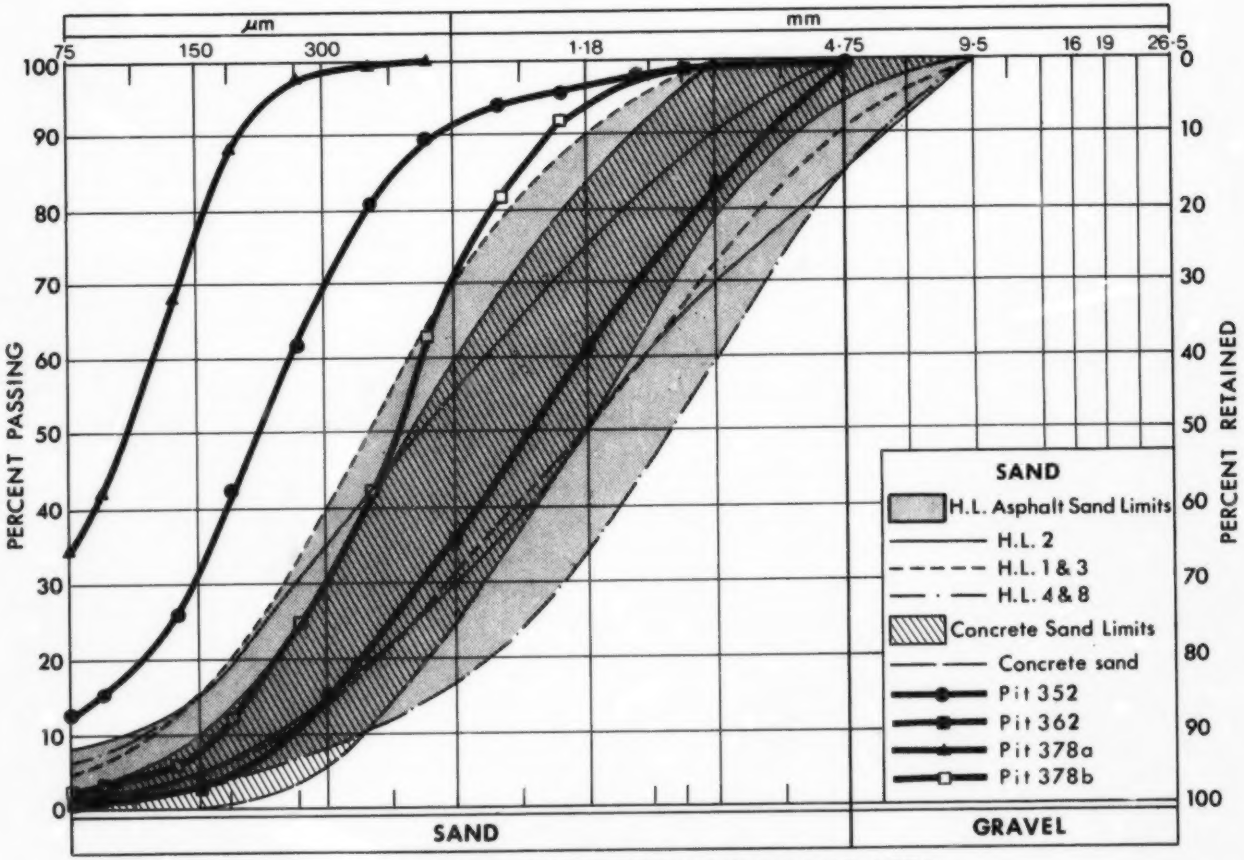


FIGURE 24b: AGGREGATE GRADING CURVES, **PARRY SOUND MAP AREA;**

Based on analysis of the sand fraction of the aggregate contained in unprocessed samples (gradation envelopes adapted from M.T.C. Forms 1002, 1979 and 1003, 1981).

NOTE:

Information portrayed by grading curves refers strictly to a specific sample taken at the time of field investigation. Due to the inherent variability of sand and gravel deposits care should be exercised in extrapolating such information to the rest of the deposit.

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Appendix A — Suggested Additional Reading

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Appendix B — Glossary

ABRASION RESISTANCE: Tests such as the Los Angeles abrasion test are used to measure the ability of aggregate to resist crushing and pulverizing under conditions similar to those encountered in processing and use. Measuring resistance is an important component in the evaluation of the quality and prospective uses of aggregate. Hard, durable material is preferred for road building.

ABSORPTION CAPACITY: Related to the porosity of the rock types of which an aggregate is composed. Porous rocks are subject to disintegration when absorbed liquids freeze and thaw, thus decreasing the strength of the aggregate.

AGGREGATE: Any hard, inert, construction material (sand, gravel, shells, slag, crushed stone or other mineral material) used for mixing in various-sized fragments with a cement or bituminous material to form concrete, mortar, etc., or used alone for road building or other construction. Synonyms include mineral aggregate and granular material.

AGGREGATE ABRASION VALUE: This test directly measures the resistance of aggregate to abrasion with silica sand and a steel disk. The higher the value, the lower the resistance to abrasion. For high quality asphalt surface course uses, values of less than 6 are desirable.

ALKALI-AGGREGATE REACTION: A chemical reaction between the alkalis of Portland cement and certain minerals found in rocks used for aggregate. Alkali-aggregate reactions are undesirable because they can cause expansion and cracking of concrete. Although perfectly suitable for building stone and asphalt applications, alkali-reactive aggregates should be avoided for structural concrete uses.

BENEFICIATION: Beneficiation of aggregates is a process or combination of processes which improves the quality (physical properties) of a mineral aggregate and is not part of the normal processing for a particular use, such as routine crushing, screening, washing, or classification. Heavy media separation, jigging, or application of special crushers (e.g. "cage mill") are usually considered processes of beneficiation.

BLENDING: Required in cases of extreme coarseness, fineness, or other irregularities in the gradation of unprocessed aggregate. Blending is done with approved sand-sized aggregate in order to satisfy the gradation requirements of the material.

BULK RELATIVE DENSITY: An aggregate with low relative density is lighter in weight than one with a high relative density. Low relative density aggregates (less than about 2.5) are often non-durable for many aggregate uses.

CAMBRIAN: The first period of the Paleozoic Era, thought to have covered the time between 570 and 500 million years ago. The Cambrian precedes the Ordovician Period.

CLAST: An individual constituent, grain or fragment of a sediment or rock, produced by the mechanical weathering of larger rock mass. Synonyms include particle and fragment.

CRUSHABLE AGGREGATE: Unprocessed gravel containing a minimum of 35 percent coarse aggregate larger than the No. 4 sieve (4.75 mm) as well as a minimum of 20 percent greater than the 26.5 mm sieve.

DELETERIOUS LITHOLOGY: A general term used to designate those rock types which are chemically or physically unsuited for use as construction or road-building aggregates. Such lithologies as chert, shale, siltstone and sandstone may deteriorate rapidly when exposed to traffic and other environmental conditions.

DRIFT: A general term for all unconsolidated rock debris transported from one place and deposited in another, distinguished from underlying bedrock. In North America, glacial activity has been the dominant mode of transport and deposition of drift. Synonyms include overburden and surficial deposit.

DRUMLIN: A low, smoothly rounded, elongated hill, mound, or ridge composed of glacial materials. These landforms were formed beneath an advancing ice sheet, and were shaped by its flow.

EOLIAN: Pertaining to the wind, especially with respect to landforms whose constituents were transported and deposited by wind activity. Sand dunes are an example of an eolian landform.

FINES: A general term used to describe the size fraction of an aggregate which passes (is finer than) the No. 200 mesh screen (0.075 mm). Also described informally as "dirt", these particles are in the silt and clay size range.

GLACIAL LOBE: A tongue-like projection from the margin of the main mass of an ice cap or ice sheet. During the Pleistocene Epoch several lobes of the Laurentide continental ice sheet occupied the Great Lakes basins. These lobes advanced then melted back numerous times during the Pleistocene, producing the complex arrangement of glacial material and landforms found in Ontario.

GNEISS: A coarse-textured metamorphic rock with the minerals arranged in parallel streaks or bands.

Gneiss is relatively rich in feldspar. Other common minerals found in this rock include quartz, mica, amphibole and garnet.

GRADATION: The proportion of material of each particle size, or the frequency distribution of the various sizes which constitute a sediment. The strength, durability, permeability and stability of an aggregate depend to a great extent on its gradation. The size limits for different particles are as follows:

Boulder	more than 200 mm
Cobbles	75-200 mm
Coarse Gravel	26.5-75 mm
Fine Gravel	4.75-26.5 mm
Coarse Sand	2-4.75 mm
Medium Sand	0.425-2 mm
Fine Sand	0.075-0.425 mm
Silt, Clay	less than 0.075 mm

GRANITE: A coarse-grained, light-coloured rock that ordinarily has an even texture and is composed of quartz, and feldspar with either mica, hornblende or both.

GRANULAR BASE COURSE: Components of the pavement structure of a road, which are placed on the subgrade and are designed to provide strength, stability and drainage, as well as support for surfacing materials. Several types have been defined: Granular Base Course A consists of crushed and processed aggregate and has relatively stringent quality standards in comparison to Granular Base Course B and C which are usually pit-run or other unprocessed aggregate.

HOT-LAID (OR ASPHALTIC) AGGREGATE: Bituminous, cemented aggregates used in the construction of pavements either as surface or bearing course (HL 1, 3 and 4), or as binder course (HL 2 and 8) used to bind the surface course to the underlying granular base course.

LITHOLOGY: The description of rocks on the basis of such characteristics as colour, structure, mineralogic composition and grain size. Generally, the description of the physical character of a rock.

LOS ANGELES ABRASION AND IMPACT TEST: This test measures the resistance to abrasion and the impact strength of aggregate. This gives an idea of the breakdown that can be expected to occur when an aggregate is stockpiled, transported, and placed. Values less than about 35 percent indicate potentially satisfactory performance for most concrete and asphalt uses. Values of more than 45 percent indicate that the aggregate may be susceptible to excessive breakdown during handling and placing.

MAGNESIUM SULPHATE SOUNDNESS TEST: This test is designed to simulate the action of freezing and thawing on aggregates. Those aggregates which are susceptible will usually break down and give high losses in this test. Values greater than about 12 to 15 percent indicate potential problems for concrete and asphalt coarse aggregate.

MELTWATER CHANNEL: A drainage way, often terraced, produced by water flowing away from a melting glacier margin.

PETROGRAPHIC EXAMINATION: An aggregate quality test based on known field performance of various rock types. In Ontario the test result is a Petrographic Number (PN). The higher the PN the lower the quality of the aggregate.

PLEISTOCENE: An epoch of the recent geological past incuding the time from approximately 2 million years ago to 7000 years ago. Much of the Pleistocene was characterized by extensive glacial activity and is popularly referred to as the "Great Ice Age".

POLISHED STONE VALUE: This test measures the frictional properties of aggregates after 6 hours of abrasion and polishing with an emery abrasive. The higher the PSV, the higher the frictional properties of the aggregate. Values less than 45 indicate marginal frictional properties, while values greater than 55 indicate excellent frictional properties.

POSSIBLE RESOURCE: Reserve estimates based largely on broad knowledge of the geological character of the deposit and for which there are few, if any, samples or measurements. The estimates are based on assumed continuity or repetition for which there are reasonable geological indications.

PRECAMBRIAN: The earliest geological period extending from the consolidation of the earth's crust to the beginning of the Cambrian.

SOUNDNESS: The ability of the components of an aggregate to withstand the effects of various weathering processes and agents. Unsound lithologies are subject to disintegration caused by the expansion of absorbed solutions. This may seriously impair the performance of road-building and construction aggregates.

TILL: Unsorted and unstratified rock debris, deposited directly by glaciers, and ranging in size from clay to large boulders.

WISCONSINAN: Pertaining to the last glacial period of the Pleistocene Epoch in North America. The Wisconsinan began approximately 100 000 years ago and ended approximately 7000 years ago. The glacial deposits and landforms of southern Ontario are predominantly the result of glacial activity during the Wisconsinan Stage.

Appendix C — Geology of Sand and Gravel Deposits

The type, distribution, and extent of sand and gravel deposits in Ontario are the result of extensive glacial and glacially influenced activity in Wisconsinan time during the Pleistocene Epoch, approximately 100 000 to 7000 years ago. The deposit types reflect the different depositional environments that existed during the melting and retreat of the continental ice masses, and can readily be differentiated on the basis of their morphology, structure, and texture. The deposit types are described below.

GLACIOFLUVIAL DEPOSITS

These deposits can be divided into two broad categories: those that were formed in contact with (or in close proximity to) glacial ice, and those that were deposited by meltwaters carrying materials beyond the ice margin.

Ice-Contact Terraces (ICT) These are glaciofluvial features deposited between the glacial margin and a confining topographic high, such as the side of a valley. The structure of the deposits may be similar to that of outwash deposits, but in most cases the sorting and grading of the material is more variable and the bedding is discontinuous because of extensive slumping. The probability of locating large amounts of crushable aggregate is moderate, and extraction may be expensive because of the variability of the deposits both in terms of quality and grain size distribution.

Kames (K) Kames are defined as mounds of poorly sorted sand and gravel deposited by meltwater in depressions or fissures on the ice surface or at its margin. During glacial retreat, the melting of supporting ice causes collapse of the deposits, producing internal structures characterized by bedding discontinuities. The deposits consist mainly of irregularly bedded and crossbedded, poorly sorted sand and gravel. The present forms of the deposits include single mounds, linear ridges (crevasse fillings) or complex groups of landforms. The latter are occasionally described as "undifferentiated ice-contact stratified drift" (IC) when detailed subsurface information is unavailable. Since kames commonly contain large amounts of fine-grained material and are characterized by considerable variability, there is generally a low to moderate probability of discovering large amounts of good quality, crushable aggregate. Extractive problems encountered in these deposits are mainly the excessive variability of the aggregate and the rare presence of excess fines (silt- and clay-sized particles).

Eskers (E) Eskers are narrow, sinuous ridges of sand and gravel deposited by meltwaters flowing in tunnels within or at the base of glaciers, or in channels on the ice surface. Eskers vary greatly in size. Many, though not all eskers, consist of a central core of poorly sorted and stratified gravel characterized by a wide range in grain size. The core material is often draped on its flanks by better sorted and stratified sand and gravel. The deposits have a high probability of containing a large proportion of crushable aggregate, and since they are generally built above the surrounding ground surface, are convenient extraction sites. For these reasons esker deposits have been traditional aggregate sources throughout Ontario, and are significant components of the total resources of many areas.

Some planning constraints and opportunities are inherent in the nature of the deposits. Because of their linear nature, the deposits commonly extend across several property boundaries leading to unorganized extractive development at numerous small pits. On the other hand, because of their form, eskers can be easily and inexpensively extracted and are amenable to rehabilitation and sequential land use.

Undifferentiated Ice-Contact Stratified Drift (IC) This designation may include deposits from several ice-contact, depositional environments which usually form extensive, complex landforms. It is not feasible to identify individual areas of coarse-grained material within such deposits because of their lack of continuity and grain size variability. They are given a qualitative rating based on existing pit and other subsurface data.

Outwash (OW) Outwash deposits consist of sand and gravel laid down by meltwaters beyond the margin of the ice lobes. The deposits occur as sheets or as terraced valley fills (valley trains) and may be very large in extent and thickness. Well developed outwash deposits have good horizontal bedding and are uniform in grain size distribution. Outwash deposited near the glacier's margin is much more variable in texture and structure. The probability of locating useful crushable aggregates in outwash deposits is moderate to high depending on how much information on size, distribution and thickness is available.

Subaqueous Fan (SF) Subaqueous fans are formed within or near the mouths of meltwater conduits when sediment-laden meltwaters are discharged into a standing body of water. The geometry of the resulting deposit is fan- or lobe-shaped. Several of these lobes may be joined together to form a larger, continuous sedimentary body. Internally, subaqueous fans consist of stratified sands and gravels which may exhibit wide variations in grain size distribution. As these features were deposited under glacial lake waters, silt and clay which settled out of these lakes may be associated in varying amounts with these deposits. The variability of the sediments and presence of fines are the main extractive problems associated with these deposits.

Alluvium (AL) Alluvium is a general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during postglacial time by a stream as sorted or semi-sorted sediment, on its bed or on its floodplain. The probability of locating large amounts of crushable aggregate in alluvial deposits is low, and they have generally low value because of the presence of excess silt- and clay-sized material. There are few large postglacial alluvium deposits in Ontario.

GLACIOLACUSTRINE DEPOSITS

Glaciolacustrine Beach Deposits (LB) These are relatively narrow, linear features formed by wave action at the shores of glacial lakes that existed at various times during the deglaciation of Ontario. Well developed lacustrine beaches are usually less than 20 feet (6 m) thick. The aggregate is well sorted and stratified and sand-sized material commonly predominates. The composition and size distribution of the deposit depends on the nature of the source material. The probability of obtaining crushable aggregate is high when the material is developed from coarse-grained materials such as a stony till, and low when developed from fine-grained materials. Beaches are relatively narrow, linear deposits, so that extractive operations are often numerous and extensive.

Glaciolacustrine Deltas (LD) These features were formed where streams or rivers of glacial meltwater flowed into lakes and deposited their suspended sediment. In Ontario such deposits tend to consist mainly of sand and abundant silt. However, in near-ice and ice-contact positions, coarse material may be present. Although deltaic deposits may be large, the probability of obtaining coarse material is generally low.

Glaciolacustrine Plains (LP) The nearly level surface marking the floor of an extinct glacial lake. The sediments which form the plain are predominantly fine to medium sand, silt, and clay, and were deposited in relatively deep water. Lacustrine deposits are generally of low value as aggregate sources because of their fine grain size and lack of crushable material. In some aggregate-poor areas, lacustrine deposits may constitute valuable sources of fill and some granular base course aggregate.

GLACIAL DEPOSITS

End Moraines (EM) These are belts of glacial drift deposited at, and parallel to, glacier margins. End moraines commonly consist of ice-contact stratified drift and in such instances are usually called kame moraines. Kame moraines commonly result from deposition between two glacial lobes (interlobate moraines). The probability of locating aggregates within such features is moderate to low. Exploration and development costs are high. Moraines may be very large and contain vast aggregate resources, but the location of the best areas within the moraine is usually poorly defined.

EOLIAN DEPOSITS

Windblown Deposits (WD) Windblown deposits are those formed by the transport and deposition of sand by winds. The form of the deposits ranges from extensive, thin layers to well developed linear and crescentic ridges known as dunes. Most windblown deposits in Ontario are derived from, and deposited on, pre-existing lacustrine sand plain deposits. Windblown sediments almost always consist of fine to coarse sand and are usually well sorted. The probabiltiy of locating crushable aggregate in windblown deposits is very low.

Appendix D — Aggregate Quality Testing

Four types of aggregate quality tests have been performed on selected samples from the project area. A description and the specification limits for each test are included in this appendix. Although a specific sample meets or does not meet the specification limits for a certain product, it may or may not be acceptable for that use based on field performance. Additional quality tests other than the four major tests listed in this appendix can be used to determine the suitability of an aggregate. The above four types of tests were performed by the Soils and Aggregates Section, Engineering Materials Office, Ontario Ministry of Transportation.

Absorption Capacity Related to the porosity of the rock types of which an aggregate is composed. Porous rocks are subject to disintegration when absorbed liquids freeze and thaw, thus decreasing the strength of the aggregate. This test is conducted in conjunction with the determination of the sample's relative density.

Los Angeles Abrasion and Impact Test: This test measures the resistance to abrasion and the impact strength of aggregate. This gives an idea of the breakdown that can be expected to occur when an aggregate is stockpiled, transported, and placed. Values less than about 35 percent indicate potentially satisfactory performance for most concrete and asphalt uses. Values of more than 45 percent indicate that the aggregate may be susceptible to excessive breakdown during handling and placing.

Magnesium Sulphate Soundness Test This test is designed to simulate the action of freezing and thawing on aggregate. Those aggregates which are susceptible will usually break down and give high losses in this test. Values greater than about 12 to 15 percent indicate potential problems for concrete and asphalt coarse aggregate.

Petrographic Examination Individual aggregate particles in a sample are divided into categories good, fair, poor, and deleterious, based on their rock type (petrography) and knowledge of past field performance. A petrographic number (PN) is calculated. The higher the PN, the lower the quality of the aggregate.

TABLE D1. SELECTED QUALITY REQUIREMENTS FOR MAJOR AGGREGATE PRODUCTS.

	TYPE OF TEST				
	COARSE AGGREGATE				FINE AGGREGATE
TYPE OF MATERIAL	Petrographic Number Maximum	Magnesium Sulphate Soundness - Max. % Loss	Absorption Maximum %	Los Angeles Abrasion Maximum % Loss	Magnesium Sulphate Soundness Maximum % Loss
Granular Base A	200	-	-	60	-
16 mm Crushed Type 'A'	160	-	-	35	-
16 mm Crushed Type 'B'	200	-	-	60	-
Granular Subbase B	250	-	-	-	-
Granular Subbase C	250	-	-	-	-
Granular Subbase D	-	-	-	-	-
Hot Mix - HL 1	100	5	1.0	15	16
Hot Mix - HL 2	-	-	-	-	20
Hot Mix - HL 3	135	12	1.75	35	16
Hot Mix - HL 4	160	12	2.0	35	20
Hot Mix - HL 8	160	15	2.0	35	20
Structural Concrete and Concrete Base	140	12	2.0	35	16
Pavement Concrete and Exposed Structure Deck	125	12	2.0	35	16

(Ministry of Transportation Forms 1002, 1003 and 1010)

MAPS
NOT
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CARTES
OMISES